

December 4, 1961

SPECIAL REPORTS:

- Radiation Weapons
- Hawk Missile

Aviation Week

and *Space Technology*

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Beech Model 23 Musketeer





HW14

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The Kaylock HW14 is available in sizes 10 through 24 and in other sizes to 4.

View of Kaylock HW14 2 and washer prior to assembly.

Assembled HW14 2 to reveal free spinning washer cap's drop off. Only one point of contact instead of two.

Kaylock.

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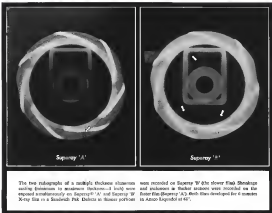
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LINC-TENCO-VOUGHT, INC.

AEROSPACE CALENDAR

- (Continued from page 5)
- physical Properties, Princeton, N. J. Spon-
sor: Heat Transfer Division, American
Society of Mechanical Engineers
- Feb. 6-7-Symposium on Secondary Tech-
niques for Computing Systems, Depart-
ment of the Interior, Washington, Wash-
ington, D. C. Sponsor: Information Sys-
tems Branch, Office of Naval Research
- Feb. 7-8-Third Winter Conference in
Military Electronics, IRE, Ambassador
Hotel, Los Angeles
- Feb. 14-16-International SolidState Cir-
cuits Conference, Institute of Radio En-
gineers, Sheraton Hotel and University of
Pennsylvania, Philadelphia, Pa.
- Feb. 19-21-Surge Antennaism and
Tracking of Aerospace Vehicles, Institute
of the Aerospace Sciences, San Fran-
cisco, Calif.
- Feb. 23-Mar. 1-Third Annual Symposium
on Nondestructive Testing of Aircraft
and Missile Components (includes both),
Gentry Hotel, San Antonio, Tex. Spon-
sor: South Texas Section-Society for Non-
destructive Testing, Southwest Research
Institute
- Feb. 23-Mar. 3-Symposium on the Appli-
cation of Switching Theory to Space
Technology, Palo Alto, Calif. Sponsor:
Lockheed Aircraft Corp., Air Force Office
of Scientific Research
- Mar. 1-5-Rights, Socialization and Semi-con-
ductor Counter Symposium, IRE, Moon-
base Hotel, Washington, D. C.
- Mar. 1-5-Southwest Annual Civil Aviation Con-
ference and Aviation Show, American So-
ciety of Mechanical Engineers, Sheraton
Hilton Hotel, Phoenix, Ariz.
- Mar. 6-10-Exhibit of the Aerospace Ser-
vices Flight Propulsion Meeting (also
held), Cleveland, Ohio
- Mar. 14-16-Glenn Research Conference,
American Rocket Society, Hotel Con-
stant, Berkeley, Calif.
- Mar. 16-18-International Convention, In-
stitute of Radio Engineers, Columbia and
Waldorf Astor, New York
- Mar. 20-22-Third Symposium on Exploiting
Special Aspects of Magnetohydrody-
namics, University of Rochester, Rochester,
N. Y. Sponsor: American Institute of
Electrical Engineers, Institute of the Aero-
space Sciences, Institute of Radio En-
gineers, University of Rochester
- Apr. 1-6-Mid-Year Conference, Aero-
space Control, Sheraton Hotel,
Washington, D. C.
- Apr. 13-Launch Vehicle, Structures and
Materials Conference, American Rocket
Society, Sheraton Hotel, Phoenix, Ariz.
- Apr. 14-National Aerospace Meeting (in-
cluding production forum), Society of
Automotive Engineers, Hotel Constan-
tine, New York, N. Y.
- Apr. 18-19-Symposium on The
Plasma Sheath-In Effect Upon Re-entry
Communications and Detection, New Eng-
land Technical High School, Boston, Mass. Spon-
sor: AF Cambridge Research Laboratory
- Apr. 19-21-Solid-state Conference and
Electronic Show, Institute of Radio En-
gineers, Ritz Hotel, Houston, Tex.
- Apr. 19-20-Symposium International Flight
Test Instrumentation Symposium, College
of Aeronautics, Cranfield, England



The two radiographs of a multiple thickness aluminum casting (bottom) in maximum thickness—1 inch—were exposed simultaneously on Superspeed 'A' and Superspeed 'B' X-ray film in a Standard Pak. Details in thinner portions

were recorded on Superspeed 'B' film (lower film). Superspeed and maximum in thicker sections were recorded on the faster film (Superspeed 'A'). Both films developed for 4 minutes in Anso-Liquidol at 68°.

Anso Sandwich Pak cuts X-ray time in half!

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WITH THE AIR FORCE

Ryan Firebees were again the only jet targets used at the Air Force's World Wide Weapons Meet, Williams Field—1961, in October. This is the third time Firebees have been selected for this important meet since 1958 when the Firebee pioneered the use of live flying targets at a weapons meet. This year, squadrons of the U.S. Air Force's best Century Series fighter interceptors pitted their skills against Q-3C's, the most reliable "cruiser" jet target to challenge the Air Defense Command.



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Since 1956, earlier version Ryan Firebees have made hundreds of operational flights with the U.S. Navy. Today, the newest Firebee, the transonic Q-3C1, is operational with Fleet units of the Navy and ordered in quantity for extensive use. Firebees pioneered as the first jet targets selected for Navy Weapons Meets—at Operation "Dip Coat" in 1959—and have established unmatched records of reliability for continuous on-range performance at these extended military competitions.



WITH THE ARMY

Firebees are flying at White Sands Missile Range under Ryan legend crews who assemble, fly and maintain the jet targets, in coordination with U.S. Army missile tests. For Army low-level target needs, Ryan developed the successful Firebee ground launch capability, in 1959, which is now available to all Military Services with all Firebees. Newest Army Firebees are transonic Q-3E targets now used to evaluate Army missiles for both low and high altitude performance.

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RECONNAISSANCE, THE LACK OF IT, AND A FAULTY COMMAND

The year is 1863. The Army of the Potomac, 70,000 men in blue, is pinned to battle. Facing them, General John B. Magruder's divisions of the Confederate Army of Northern Virginia finally entrenched before Richmond, but numbering only 15,000. The sheer weight of Federal men and equipment apparently is sufficient to gain the victory, destroy the Southern force, capture the Confederate capital and perhaps end the war. But General George B. McClellan, the Union Commander, never orders the advance. Why?

During the years preceding the war, adequate provisions for reconnaissance had not been made. McClellan's intelligence, directed by the famous detective Allan Pinkerton, overestimated the strength of the Confederate forces . . . misperceived their forces to be more than of

secret enemy is too inexperienced and limited in number to verify this civilian intelligence. And to this singular Union opportunity slowly slips—dissolving into three more years of bloody warfare . . . the result of a faulty command decision.

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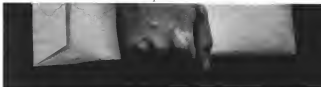
RECONNAISSANCE SPECIALISTS AND APPROPRIATIONS: AF-C-11



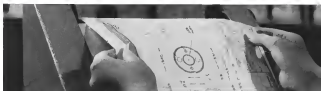
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December 4, 1961

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North American to Build Apollo Spacecraft 26

► Largest NASA contract goes to its biggest supplier, \$480 million initial figure will cover 10 vehicles

Shuttle Beats Eastern's Holiday Traffic 36

► Expanded fleet makes first turnaround, doubling line's 1950 Thanksgiving computer (opposite page)

U.S. Increases Radiation Weapons Studies 52

► Exotic weapons studied as a possible defense against KGBs; considerable research effort centers in the use of plasmas

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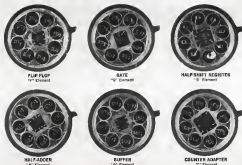
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Supply	• 5V ± 0.25V (typical)
Power	• 10 mW per element
Fan-out	• 50 max (typical range of 10-100)
Package	• 20 pin DIP (typical)
Storage	• 10 years (typical)

*See further element data in Fairchild 100

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EDITORIAL

Air Shuttle Performance

The air shuttle operated by Eastern Air Lines from the New York hub to Washington and Boston received its first severe test during the recent Thanksgiving holiday when it handled all of a substantial overflow without a hitch and without any passengers being denied a seat. For details of this operation, read Elliot Garrison's report on page 36 of this issue.

During this Thanksgiving holiday, super-shuttle service, Eastern carried its 400,000th passenger since the service, pioneered last fall, first shuttle began between New York-Washington and Boston last Apr. 30.

As a frequent Washington-New York commuter, we have been a regular frequent customer of this service since it began last fall, for on that observation of a basic new step in air transportation and now, like so many others, as a satisfied customer who has found that the service offers a great boon to the busy, regular air traveler.

Slow Fruition

The air bus concept of offering high frequency, no-halt low fare service between large metropolitan areas lacked around the airline industry for several years. The Car. of North Central Airlines, earlier some of this potential with the results of its high frequency, scheduling between Chicago and Milwaukee although it was still a standard fare, advanced innovative service and the concept of an ETC (Eastern Transport Company) Low Fare, or "Highway Airline" took another step in this direction with its no-stop, low fare, standby service on a high frequency, Pittsburgh-Philadelphia service with Super-jetted Constans.

Passenger acceptance of both these services was high almost from the start, and has shown good growth. James Pyle, then deputy administrator of the Federal Aviation Agency, also used to plan for an air bus service in his public speeches through the late 1960s.

It remained for Eastern Air Lines to present the first full-scale experiment in an air bus technique with its operation that began last Apr. 30 from the New York hub along high-density traffic spokes to Washington and Boston. The service began smoothly with flights each way every two hours between 8 a.m. and 10 p.m. As public acceptance grew, and commuters found that the guaranteed seat was indeed guaranteed—even if a second section had to be flown for a single customer—the service was expanded to even later in the hour for all three ports although the Thanksgiving holiday produced a one shuttle with planes operating almost continuously with as little as 9 min turnaround time, the entire section has become fairly routine during the peak periods of the commuter's week such as Monday morning and Friday evening.

Although the price is cheaper than standard first class fare, we feel that it is convenience rather than the lower price that is the principal attraction for the ETC air shuttle. The elimination of reservations, preflight seating, counter check-in, and baggage tagging saves a tremendous amount of time and scheduling stress for the air commuter. The on-the-hour scheduling plan the assurance of the extra section eliminates all of the strain of fighting for a seat, backing the standby line, or playing the multiple reservations roulette game. Moreover, for the frequent traveler, the small individual ticket fare savings multiply significantly over a six-month period. The on-time departure record has been good and Eastern service representatives do an efficient job of routing all customers into the shuttle coach.

The big question in the air transport industry is whether this type of air shuttle service can be profitable. Eastern's President Michael Maciejowski points the shuttle statistics personally and has stood to the Civil Aeronautics Board that the operation is "extrinsically profitable" in seeking a \$1 fare increase.

A Matter of Convenience

We don't think a \$1 per ticket fare increase is going to diminish the present popularity of the air shuttle because convenience is its primary driving force. We have noted a wider broadening of the economic spectrum of air shuttle passengers in the six months in which we have been riding it regularly. Recently, we served a heavier percentage of obviously executive traffic and saw more families than going the same way about the same time each week. Although the bulk of Eastern's recent holiday traffic consisted of vacationing college students, we have also observed unannounced personal chauffeurs meeting shuttle passengers in both Washington and New York.

The September shuttle statistics showing 50,845 passengers moving between New York and Boston, and 41,755 people flying between Washington and New York, are impressive evidence of how volume traffic can develop.

Eastern's air shuttle service experimental period has been extended to the CAB until April of 1963 when a full year's operation will be on the record for all to study. We think CAB should show some in its ongoing authorization for service, to attempt a full scale shuttle operation.

We predict the air shuttle will become a permanent part of the air transport scene as a major step forward in providing the traveling public with service of better convenience and utility.

—Robert Hertz

WHO'S WHERE

In the Front Office

Dr. Herbert F. York, Chancellor of the University of California at San Diego elected to the Board of Directors of Aero Space Corp., Los Angeles, Calif. Office Acquire appointments: V. G. Mahan, 101-11101; W. James Chastice, assistant treasurer.

Paul B. Wideman, head chairman and chief executive officer of Minneapolis Power and Regulator Co., Minneapolis. Vice president: Harold W. Smith, now chairman of the board, treasurer: James H. Hager, secretary: Mr. Wideman as president, Stephen F. Keating now elected to the sixth elected third executive vice president.

William L. Evans, head chairman and Jean P. Gaudin, vice chairman. The Ford Manufacturing Co., Milwaukee, Conn. Mr. Ford continues as president.

F. B. Newbold Jr., corporate director of Fairchild Industries Corp. is elected to the Washington (D.C.) Operations. Mr. Newbold continues as a vice president and director of the corporation and general manager of the Aviation Division.

Nelson B. Pitt, Jr., vice president and general manager of Michigan Airlines B. Thomas, President, United States Air Force, acting vice president and director.

Gerald W. Conner, president of GAFCO, Inc., Washington, D.C.

Paul W. Leslie, president, Space Propulsion Inc., Santa Ana, Calif. John Macintosh, vice president.

William W. Wright, executive vice president and administrative vice president, Instruments Inc., Los Angeles, Calif. and Robert M. Ward, vice president planning and systems vice of the corporation, operating staff.

Assistent to the President for the following: **Robert G. Galt**, vice president, Robert Galt, Inc., Los Angeles, Calif. **John C. Korman**, vice president, Korman, Inc., Los Angeles, Calif. **David N. Schuchter**, vice president and development, John E. Schuchter, Inc., Los Angeles, Calif. **Arthur M. Schuchter**, vice president, Schuchter & Perkins, Inc., Detroit, Mich.

Arthur F. Flann, vice president, American Airlines, International, Inc., Elmhurst, N.Y., a division of Standard Kollsman Industries Inc.

Dr. Frank M. Wright, group executive, Aerojet Systems Inc., Azusa, Calif., a subsidiary of Lockheed Industries Inc.

Paul T. Starnes, executive vice president of Washington National Airport.

Col. Edgar F. Barkley, chief, Aerospace Command System Office, NASA, AFOSI.

Honors and Elections

Dr. A. R. Ruffell, president of Aerojet General Corp., has been elected chairman of the Board of Directors of the Aerospace Industries Assn. for 1962 and William M. Allen, president of the Boeing Co., has been elected vice chairman. **August C. Remmen** was elected president of AIA, succeeding **Gen. David H. Cook** (AIAA) at a meeting (AIAA July 17, p. 39).

(Continued on page 111)



The "singer gear" Detachable Reusable Fitting now the USAF standard field attachable fitting for hose of Teflon

*Aerospace Technology
(Robert Smith)

INDUSTRY OBSERVER

NASA plans an attempt to demonstrate L11 capabilities of its Nike Zeus anti-missile missile in firing against a Nike Hercules anti-aircraft missile at the White Sands, N.M., proving ground probably before the middle of this month.

NASA Aviation, which abandoned development of a ground-to-air missile when the French government decided to back the U.S. Army-Northrop Hawk missile system, has begun a new program aimed at producing a light ground-to-air missile system for close support work. Need also is redesigning its successful subsonic CF-38 target vehicle for use as an anti-aircraft missile.

NASA Aviation is planning the first manned orbital flight, plus a backup capsule launch, at Cape Canaveral. Total number of capsules at National Aeronautics and Space Administration's facility there would at least four, including the one used for the orbital flight of a chimpanzee and a backup capsule for that flight (see p. 27).

Apollo manned capsule's recovery system probably will consist of three parachutes. NASA now appears to favor the global principle proposed by Republic Division of Northrup Corp., which consists of a parachute with a flexible bag for steering, over the Maggill wing approach for recovery (AIAA Nov. 6, p. 28).

Apollo 2 test program will include four launches beyond the one scheduled for late July or early August, which will test a backup parachute system. This will also test the system for the first time since the P. 1100 F. model has been fired in for launches were scheduled throughout October 1962, using Cape Canaveral Pad 11 only.

First NASA-Casimir orbiting astronomical observatory (ROM) is now in development. Mission concept is to begin in January and thermal vacuum tests are slated for March. First three of the five spacecraft being built will be used for ground testing.

Thermin plans to meet the space program requirements for NASA's 11-100 L. Saturn-A-4 stage by using two orbital modules. Combined total section is a total of three or four 0.5 m thick, aluminum alloy, with internal arch-shaped reinforced with aluminum. Thermal shield plates about 0.17 m thick, covered with a copper-plated aluminum oxide (white) layer. Large hydrogen tank will be installed externally. A bulkhead of 0.127 m thick steel, sandwich with a paper honeycomb core will separate hydrogen from liquid oxygen inside the tank structure.

NASA headquarters is ready to approve the proposed between Mark 2 Mission capsule for orbital flight before the December Apollo capsule is ready (AIAA Nov. 27, p. 25). John Chastice is expected to lead the project.

Failure of Ranger 2 (AIAA Nov. 27, p. 27) apparently resulted from a malfunctioning of the Agena rocket stage to spin, throwing the propellers to the outside of the tanks. First one of the Agena's tanks did not contain the centrifugal force during the propellers to hold in the tanks, work. The engine tank, but could have only the propellers ahead in the line.

Rensselaer are fitting all-wheel A-13 high-performance turbine with small jet engines, propellers to extend the duration of testing flights and to assist in returning to ground of takeoff.

NASA will ask for help from through Aero's Corps of Engineers for arch structural engineering programs on a second launching pad for the Cape Canaveral of the Pad is scheduled for 1963 and will be used by the existing launch tower now being built. Pad 11 which has been used for USAF Cape Canaveral research and development flights, will be modified to handle Aero's space shots.



**WHERE IDEAS
UNLOCK
THE FUTURE**

PERFORMANCE CHARACTERISTICS

VACUUM	SPECIFIED	ACHIEVED
1 x 10 ⁻⁴ mm Hg	4 hours	1 hour: 32 minutes
1 x 10 ⁻⁵ mm Hg	8 hours	3 hours: 30 minutes
1 x 10 ⁻⁶ mm Hg	16 hours	4 hours: 27 minutes

PERFORMANCE CHARACTERISTICS		
VACUUM	SPECIFIED	ACHIEVED
1 x 10 ⁻¹ mm Hg	4 hours	1 hour, 32 microns
1 x 10 ⁻² mm Hg	8 hours	2 hours, 32 microns
5 x 10 ⁻³ mm Hg	24 hours	4 hours, 27 microns
1 x 10 ⁻³ mm Hg	48 hours	7 hours, 22 microns
5 x 10 ⁻⁴ mm Hg	Delayed space	15 hours

Bendix Systems Division



Watch for a closer working relationship between Ames and Air Force in the attempt to broaden the military's role in space. Ames's policy statement on what it considers its capabilities in space, given before a recent Air Force Scientific Advisory Board meeting (AFW No. 25, p. 21), has aroused so much interest that space leaders in both services have been examining the subject further.

Renegotiation Battle

Combat Hearings

Military Airlift Bid

Results of Project Highlight, an evaluation led by Air Force to compare the importance of requirements of the two McDonnell F-101 and the USAF General Electric F-106, have indicated that the F-101 was more important for Air Defense Command, which began the project, as reflected by USAF's Accelerated Systems Division in its second year of project. F-101 is expected to be in the Air Force budget for fiscal 1967 not only as a tactical fighter but also as an defense fighter. Original programming of the F-106 is being described as a transition to a new role. Meanwhile, Air Force is making an effort to get the F-106 greater FCM regulation, possibly through use of an underway and -Washington, Staff

North American to Build Apollo Spacecraft

Largest NASA contract goes to its highest supplier; \$400-million initial figure will cover 10 vehicles.

By Evert Clark

Washington—Selection of North American Aviation, Inc., to design and build 10 to 20 three-man Apollo spacecraft for flights that eventually will put U.S. astronauts on the moon means that National Aeronautics and Space Administration will begin negotiating this week the largest contract in its three-year history with the company that already is its largest contractor.

Initial contract will cover 10 vehicles and extend to 20 more. This is twice the amount of the initial contract NASA will negotiate with the Chrysler Corp. for the Saturn S-1 booster (AW Nov. 27, p. 23), which is the largest award previously made by NASA.

Choice of North American three among the five companies or teams that submitted bids early last October upset recent theories that the Kennedy Administration would give unusually great emphasis on developing space contracts widely among companies and geographic areas—particularly since it came 11 days before the Chrysler award, which was widely interpreted as an attempt to give the automobile industry a larger role in space development.

Of the five proposals submitted for Apollo, two were from firms or teams based in Southern California, one from the East and one from the

Midwest. California holds a wide lead over all other states in the value of the NASA contracts its companies hold (AW Nov. 13, p. 38), and North American holds a wide lead over all other companies in value of NASA contracts—chiefly because its Rockwell International is building the H-1 engines for Saturn, the F1 engines for later Saturn models and the J-2 liquid hydrogen engine for Saturn upper stages. Rockwell also produces engines for the Atlas and Thor, which have been the vehicles so far in the military and civilian space program.

Apollo Timetable

The Apollo contract will call for an engineering study to be ready next August, with results from the selection date. First full-scale vehicles will fly before late in 1963 aboard Saturn boosters on built by NASA's Marshall Space Flight Center and the Chrysler-based booster will begin to be used toward the end of the 10 to 12 flights that will carry Apollo through its last period and initial manned earth-orbit flights.

North America's Space and Information Systems Division, based last Dec. 15, has chosen four research flight personnel at the Los Angeles Division and announced space personnel in the Missile Division, will design and build Apollo at Edwards. "Gold" Project manager will be John P. Jones, who will be a vice-president. Elmore Stewart heads the division.

North America will build two models of the Apollo spacecraft—the crew vehicle or "command module," and the component that will house fuel, electrical power supplies and propulsion units needed for lunar takeoff. The three modules—the lunar landing vehicle—will be attached to a separate container within an orbiter.

North America did not bid with two neighbors, although it subcontracted two or five companies that it would

prefer as subcontractors. NASA reserves the right to select subcontractors after those chosen by North America if it deems so, but if it actually did so this would be an exception to its general rule.

Martin Co. also bid alone. General Dynamics bid with Avco, General Electric bid with Douglas, General Motors with Sperry Gyroscopes, and McDonnell Aircraft bid with Lockheed. North America has offices at Hawthorne, Calif., where the early Saturn launchers are being built, and at Langley Field, Va., where the Spacecraft Center is now located. It is expected to establish an office near at Houston, Tex., to which the Spacecraft Center will be moving next year.

The Apollo vehicles will go from Downey to Houston for environmental testing, structural training, etc. All flights will be launched from the launch complex in the Apollo complex, NASA believes a slightly modified Douglas C-133 could carry the two

because last July (AW July 31, p. 28). Even before Apollo is the largest and the most important project NASA has undertaken. The contract will be a two-billion dollar job that it would give considerable weight to proposed management structure and personnel and to the amount of resources that could be devoted to Apollo.

The Space and Information Systems Division's major projects at the moment are the USARF, Mars Dog and to surface Mars and the Saturn S-1 upper stage. North project is considered at a con-

Research Projects

North America Aviation's research projects include an automatic module, a Mach 10 research vehicle, an advanced fighter-bomber and an advanced ballistic missile, according to the company. It also and Air Force is studying a proposed low-altitude Hound Dog.

This attractive low-altitude project of \$37,716,137, or \$3.34 per lb. of payload, on an order of \$1,362,512,625 in the year ending last Sept. 30—the highest order in the company's history (AW Nov. 13, p. 27).

North America before then was \$36,618,177. The \$37.1 million profit after taxes was estimated to be \$2.24 per lb. of payload on an order of \$1,362,512,625 in the year ending last Sept. 30. The order was estimated to be \$1.36 per lb. of payload on an order of \$1,362,512,625 in the year ending last Sept. 30. The order was estimated to be \$1.36 per lb. of payload on an order of \$1,362,512,625 in the year ending last Sept. 30.

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and stage from viewpoint point of view.

The overall Apollo project will be managed by NASA by Howard Hansen, director of manned space flight, and the currently portion will be managed by Robert R. Gilchrist, director of NASA's Manned Spacecraft Center. North America has offices at Hawthorne, Calif., where the early Saturn launchers are being built, and at Langley Field, Va., where the Spacecraft Center is now located. It is expected to establish an office near at Houston, Tex., to which the Spacecraft Center will be moving next year.

The Apollo vehicles will go from Downey to Houston for environmental testing, structural training, etc. All flights will be launched from the launch complex in the Apollo complex, NASA believes a slightly modified Douglas C-133 could carry the two

modules that North America will build. They also can be moved to Houston by train. Spacecraft launch to the launch site of Cape Canaveral, Fla., may be by ship. North American expects to move the Saturn S-2 stage by Navy landing ship-deck (LSB).

First Flight Tests

Some of the first flight tests will use simplified Apollo vehicles. NASA will build under models for drop tests, as well as in-flight tests, but does not intend to build any of the flight vehicles. Current estimates are the total number of Apollo that will be flown for the first phase of the program—earth-orbit, moon-orbit and landing—will be about 25. But with the first test flight still two years away this is considered too preliminary to represent an upper limit.

by a malfunction in the cooling system, which was a serious matter in a rocket. This condition was not as serious as that in the reaction motor and was beginning to correct itself when the decision was made to end the mission. It is believed that the water pump from mid-plugged the cooling system, which eventually supplied the reactor.

Temperature in the capsule rose from a "100" (normal to 86°), which was not considered critical. Because reaction in the capsule module was of the heat, a human pilot would have solved this problem by getting a steady reactor on the line. The Apollo has three in tandem—two on the attitude and environmental control loop and the other in reserve.

Gilchrist called the flight "a superb performance," and said new life data was lost in terminating the flight early. The final taking part of the mission was the new data-link network, which was able to analyze data and act on it quickly.

The flight trajectory began faultlessly after several hours caused by loss of data

Chimp Shot Raises Hope That U.S. Can Orbit Man Before Year's End

By Edward H. Kolcz

Cape Canaveral—Hopes for an orbital flight by a U.S. astronaut late this month were revived by the successful flight last week of a chimpanzee on the Project Mercury capsule on a two-orbit mission.

Mercury officials told *Aerospace Week*, however, that there is no guarantee as to when to attempt the next flight before Dec. 31, and the estimated mission will not be flown until its chances of success are assured.

Concerned by reports that there has been progress from the Administration and National Aeronautics and Space Administration, budgetary in the U.S. manned flight on the second launch this year, Walter C. Williams, associate director of NASA's Manned Spacecraft Center, and the last before the year ends, said he will continue this schedule.

Williams said the progress that this preliminary program has been made in half speed and now must go into a rapid program to accomplish orbital flight in the near view in Soviet Russia as a first step.

First in the chimpanzee flight, designated MA-1, the second orbital flight was scheduled for Dec. 28, with the chance that it could be run up a week of the chimpanzee flight were finished. NASA announced the flight next (see Nov. 28 for the first test orbital mission), but Robert R. Gilchrist, director of the Manned Spacecraft Center, said that in no way concern NASA to a P-61 flight.

MA-5, scheduled to be a three-orbit

mission, was launched at 10:07 a.m. EST Nov. 28 but was ended after two orbits because of malfunctions that NASA and could have been corrected by a human pilot. The Machin, Australia, tracking station detected a failure in the radio system and an increase in cabin temperature during the second orbit. Those conditions were monitored by stations at Woomera, Australia, and at Houston.

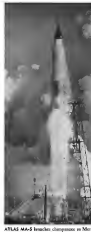
Christopher C. Kraft, Mercury's flight director here, made the decision to end the mission. Radio notes were lost at 1:35 p.m. EST on ground control from the Ft. Apache Station, Calif.

The capsule splashed at 1:28 p.m. EST (2:02 a.m. on day south of Bermuda) and was retrieved at 2:55 p.m. EST by the nuclear-jacketed *Avenger* USS *Stromer*.

Preliminary data indicated that those conditions existed before the decision to end the mission after two orbits.

• All reactions did not respond to the correction of air system, either because the cold system struck open or closed. The capsule had started to go into a roll displacement, which was observed by Machin. A completely adequate manual override would have been used by a pilot to correct this condition. A significant amount of hydraulic pressure for the control jets had been expended, and rather than risk an unpowered attitude, officials brought the capsule down while it was possible to correct it. The correct attitude could have produced the capsule into an elliptical orbit.

• Overheating of the capsule was caused



ATLAS MA-5 launches chimpanzee in Mercury capsule on two-orbit flight Nov. 28.



CHAMPANGE is shown before M45 launch. Its aluminum and plastic capsule was removed to Mission capsule's environmental control loop.

and computer links between Goddard Space Flight Center in Washington, D.C., and several of the tracking stations.

The General Dynamics Afton launch vehicle weighed 264,700 lb at liftoff. It followed the planned boost cycle with booster shutdown 131 sec. after liftoff when it was at an altitude of 18 mi and 52 mi downrange and reaching at a velocity of 16,130 ft/sec. The engine nozzles were attached 154 sec. after launch and the booster and service engines shut down simultaneously at 164 sec. after launch. The capsule separated from the vehicle at an altitude of 16,130 ft. The 14,600-lb empty Afton vehicle also went into orbit but was not tracked and was expected to reenter after two to three orbits.

The capsule had a range of 99 mi, an apogee of 145 mi, and a period of 85.5 min. There was no damage to the

pad, and B. G. MacNab, General Dynamics general manager here, and it could be used for the M45 launch vehicle at anytime Nov. 24. He said the M45 vehicle, Atlas 1980, was launched on a Douglas C-119 at San Diego just after the champagne was launched for immediate delivery to the Cape.

Two Navy Douglas A1D aircraft also supported the capsule as it was launched through the numerous defense pass over zone from 37,000 to 40,000 ft altitude.

Observers of the M45 flight were to provide precise motion tests for all launch vehicles, capsule and ground systems at a final qualification before named orbital flight, with all core position data of those to be in the atmosphere flight.

The male champagne passenger, Egon, weighed 37.5 lb. He is 64 months old, but has been under training by the Air Force Space Command at Hurler Air Force, N. M., for the past 18 months. The champagne was 39 years old, reported throughout the flight, designed to compare its ground performance with performance in space. There were no problems.

• **Shock avoidance** by depressing a lever at the right side of the sealed cabin at each zero, 20 sec. A red light appeared over the lever 120 sec. before launch, and remained lit for 15 min. On the ground, the ship is engaged 94 lever depressions each minute.

• **Reaction measurement**, by turning all a blue light to read shock. The task was done simultaneously with the red light test and was designed to determine the speed with which the champagne could turn off the light. The blue light,

at the left side of the cabin, lit for five seconds every 30 minutes. Glass reaction time for the champagne was one second.

- **Roll period** for the reaction, with no body.
- **Differential measurement**, to determine thrust in space. Egon, on a low water that before launch, was trained to walk a single wheel a green light glowed above it. That test lasted 12 min, and the champagne could absorb 20 shocks of water during this period.
- **Seismic test**, to prove.
- **Reaction test**, to show the champagne a human pellet for depressing a lever identified by a yellow light. Every time the animal hit the lever 50 times, a pellet was ejected between two rubber fingers. During ground tests Egon was really received 120 pellets during the 12 minute test.

- **Roll period** for the reaction.
- **Negative odd art test**, in which 15 different patterns were flashed above the lever during a 12-min odd cycle with an odd number. In order to avoid a shock, the champagne had to eliminate the odd number. Egon passed score last completed 58.77% correctly.

The champagne was housed in an aluminum and plastic capsule which was connected to the environmental control loop. NASA said that it has received the fault which caused an abnormal high oxygen consumption during the M45 flight (AW Sept. 18, p. 32). Launch objectives in M45 included the champagne's ability to handle to move, in the open position.

The capsule carried those 16 raw, content and one 70 mm camera to photograph the champagne, the mission at the Cape, through the periscope, and the view through the capsule window. Four reduction camera pods also were carried, two of them to measure total design, and two designed to determine motion and time.

There were 75 heat sensors in the capsule, but NASA said none and no before now not sampled because previous tests had indicated they were not sufficient to cause fire.

M45 mission was the first designed to test the 14,600-lb Mission taking and communication network. The \$7-million network was completed by Western Electric Co., prime network contractor, Feb. 11. Data from the mission was sent by the network to NASA's Goddard Space Flight Center IBM 7090 computers, interpreted and stored automatically to the Mission data center here.

In the recovery area, a crew from Air Corps recovered recently with sensors and seismographs while flying in a USAF aircraft. This technique was necessary because the plane directly above the champagne could prevent telemetry transmission.



Ryan to Build Fan-in-Wing Aircraft

Two fan-in-wing research aircraft will be designed and built for Army's VORC, with progress by Ryan International Co. and its subsidiary to General Dynamics Co. Ryan has a contract to develop the aircraft which will be used to evaluate flight characteristics of the M45 system in lower and transition, and to demonstrate high-altitude research flight. Design studies are now well in progress. First flight date is scheduled for May 1981. Phase 1 contract for 160 aircraft, covering one complete engine plus propulsion and airframe for a second, was awarded to GE last

month by Army Transportation Research Command. About half of that sum will go to Ryan for software development and maintenance. Total contract cost will be \$185 million and will cover 24-month program. Air Force will contribute in financing the GE 301 engine and shorter tubes which supply power to the jet. General Dynamics has been awarded 161 fans. GE asked for proposals on the overall aircraft in a competition which Ryan won with the concept. Ryan work will include further design and construction of the aircraft.

UN Space Group's Usefulness in Doubt

United Nations Committee on the Peaceful Uses of Outer Space, the international body, the United Nations hopes to establish international cooperation and harmony in space exploration, appears to be headed for an increased future but uncertain membership in the Soviet Union wants the right to effectively veto any resolution proposal.

The Mexican committee met last week for the first time since its establishment in 1958. The committee was created by the General Assembly in December, 1958 and elected Dr. Franco Mitter, Austria, as its chairman, Paul Michel, Hungary, Romania, as vice-chairman and Corrado de Carvalho Silva, Brazil, as secretary general. It heard a statement from a number of the representative states and then adopted a resolution which reaffirmed the status of the United Nations, the nations in its membership and a resolution to the various nations of the representative states to be forwarded to the Political and Security Committee, to which it reports.

The committee is expected to pass the matter on to the General Assembly soon. UN officials believe that a vote will be taken, extending the mandate of the Committee on the Peaceful Uses of Outer Space beyond its present Dec. 31, 1981 expiration date.

Formerly, under the committee's failure to meet for the past two years has been the reluctance of the U.S. and the Soviet Union to accept each other's proposed procedural rules. The U.S. has suggested that the committee open its door along the same general lines of other

major UN groups, with decisions reached by a majority vote. Valeriy A. Zorin, Soviet permanent representative to the UN, indicated the committee of Soviet, U.S. and the flights of Yon Capoen and Gherman Titov and that "the Soviet Union includes the greatest assistance in the development of international cooperation in the important field of outer space exploration."

The Soviet delegate said that the USSR was in favor of such a position but that "it must be emphasized that effective international cooperation in the field of outer space is not to be developed only on the condition that it is carried out on the basis of the genuine equality of states."

If an agreement is to be reached in the future, the committee is a particular group of members, then of course it will not be the same group of effective cooperation and it can be believed that in such an event, the work of the Committee on the Peaceful Uses of Outer Space would be.

To some, genuine equality of states "Zorin suggested that all countries decisions be reached by unanimous vote. Because it is not in the manner that the possibility could be characterized by the adoption of decisions by a majority vote of states in the interest of that at that closed group of states."

Charles W. Yant, U.S. deputy permanent representative to the UN, said that the committee would be required for "unanimous" air treaty

must to veto power over the committee's operations and that the U.S. could not agree to it. Yant said that he believed that the committee's mandate would be renewed and that the operation's membership probably would be expanded to include some Asian nations.

During the committee's 14th session, Yant said that there are four "outstanding issues" which the UN General Assembly should take immediately to "promote peace in outer space and extend to all nations the benefits of exploring it."

• **Acknowledgment** that international law and the UN charter extend to the field of outer space and outer space activities that are not subject to national appropriation by claim of sovereignty.

• **Registration** of all space vehicles, with the UN Secretary-General maintaining a central record of space launch data.

• **International sharing** of the benefits derived from space technology, with particular reference to developing. The U.S. announced that the World Meteorological Organization undertake "initiatives to advance the state of atmospheric sciences and technology and to develop existing weather forecasting systems and help member states make effective use of these through regional meteorological centers."

• **Development** of communication satellites, as a global and non-military system, to expand and improve international understanding.

Orbit Pilots Chosen

Depa Chandross-McIntire Lt. Col. John H. Gross and USAF Maj. Donald R. Skyles will be the primary pilots for the first two Pioneer Mission orbital flights.

Col. M. Scott Carpenter will be Col. Gross's backup and Col. Walter M. Schmitt will be the backup for Maj. Skyles. The first two U.S. astronauts, Col. Alan B. Shepard and USAF Capt. Virgil G. Gibson, will be dual taskload pilots. USAF Maj. L. Gordon Cooper will be in charge of launch area, emergency egress and launch abort egress.

Defense to Streamline Industry Contacts

By Larry Rood

Washington-Logistics Management Institute, the non-profit, backfiring research organization created recently by the Defense Department, will become the focal point for exchange of ideas between Defense procurement policy makers and industry.

Top Defense officials, faced with an enormous number of contacts with organizations representing a wide variety of industry, will try that approach as so frequent to reduce duplication.

"They are anxious to streamline the communications process without losing the expression that the department is the administration's chief spokesman."

On the other side, industry itself has become increasingly preoccupied on how best to have its points of view presented to Defense officials. Many large companies have developed their defense business and have joined a variety of trade associations (see box). They are aware that themselves being represented by several groups with varying ideas.

These industry organizations and other representative of the various and often intersecting groups compete for the time and attention of Defense officials and military officials, who find themselves working long hours and often having to spend money in fulfilling speaking engagements or otherwise fulfilling part in industry-sponsored meetings.

It is in the eyes of procurement managers that the need for a unified industry voice is considered greatest.

The department does not want to change rules affecting contracts, patents, etc., without discussing them at length with industry in order to avoid awkward working arrangements.

Idea Exchange Needed

A prime subject in that of contacts. The last point type of contact is being subjected to a greater extent by cost-based and incentive contracts (AWN Nov. 23, p. 36). To protect the interests of the government, as well as of those it is necessary to ensure that rules governing contract modification provide for economic in development and production without imposing an unduly strict set of controls on either government and industry that would then be unworkable.

General and the industry sectors there should be told. "You people get together. Form a composite group to discuss specific matters under our call." He said that would be a form of all law cooperation.

This approach was used recently for the first time in a private meeting with eight representatives of manufacturers. They were told that if they could get together and speak with one voice they would have more opportunities to talk to Defense officials. This also were told

that individual industry contacts will be discouraged.

In choosing the Logistics Management Institute as the principal central contact point for industry, consideration was given to the point that the LMI officials will have more time to listen than Defense officials, since LMI will need full time on procurement policy matters. It will follow policy guidelines laid down by Defense in listening to industry and recommending changes.

LMI is part presently to be an organization under Dr. Sterling Livingston, who is on leave from Harvard University as interim president until Jan. 1. It will concentrate on what to him, how much to say and how to say it most effectively and efficiently.

For its first year LMI has been awarded a \$600,000 contract (AWN Nov. 27, p. 25) to focus its efforts on the following areas:

- **Streamlining administrative and personal practices.** Propose action plans for selecting and training top logistics personnel, establishing uniform cost accounting procedures and in using procurement operations by contracting personnel.
- **Strengthening administrative and personal practices.** Propose action plans for selecting and training top logistics personnel, establishing uniform cost accounting procedures and in using procurement operations by contracting personnel.
- **Recommendations planning.** Emphasis will be on developing a system for rapid determination of procurement objectives, analysis of needs, evaluation of readiness, ways to address the critical needs, development of specific performance of carrying capacity and cost of engineering and technical data acquired, and seeking methods by which the effort of procurement handling on cost and performance may be determined.
- **Specifications, standards and designs.** This will involve a program to eliminate

unnecessary specifications and convert quality standards, and recommend improved methods for controlling engineering and design changes.

• **Competition in defense buying.** Ways will be studied to increase competition in the purchase of production quantities of new equipment, components and parts.

• **Reducing cost of procurement practices.** This will include appraisal of problems involving evaluation of contractors' qualifications, reducing proposed costs, improving major parts pricing, simplifying purchasing procedures and avoiding a fair proportion of defense contracts to small business.

• **Control of contractors' performance.** Activities will be directed to the status of scheduled work and technical performance and exploring a means of making more effective use of contract incentives.

• **Strengthening administrative and personal practices.** Propose action plans for selecting and training top logistics personnel, establishing uniform cost accounting procedures and in using procurement operations by contracting personnel.

Secretary of Defense Robert S. McNamara and records that he felt "one of the activities will serve as an important function of bringing to bear on the complex problems of defense logistics the most experienced, capable and creative business management. While our top civilian and military leaders still are assumed to be capable people, they may not be accepted with entire loyalty to day operations that they are unable to develop contemporary time to the detailed studies and analysis which are required."

He said the contracts will have a working level staff of 30 to 150 men, men with broad consulting and research experience in procurement and logistics issues studies will be subcontracted to universities and private consulting firms when specialized knowledge is required.

Defense officials also are expected over reports from professional societies and other special interest organizations for participation in meetings. In most cases on the purpose and the interests of groups or clubs are identical.

Two large organizations are mentioned as examples are the Institute of the Aerospace Sciences and the American Rocket Society.

A note was made last year toward a merger of these two associations that it failed. They and other organizations will be subjected to public pressure to hold joint meetings or to merge, through selective acceptance by Defense officials of speaking engagements and be control of professional papers.

No centralized office has yet been ordered, but high officials are encouraging these ideas.

Defense Department Will Unify Non-profit Organization Policy

Washington-Defense Department will cut across service lines and develop a coordinated policy for dealing with non-profit organizations engaged in military research.

Russell L. Gifford, deputy secretary of defense, and his special assistant, Adam Yarmulinsky, will coordinate the effort. Gifford said he was "anxious about the need to relate these diverse activities of the various military departments in the non-profit field (AWN Dec. 18, p. 3).

Currently, the Defense Department's general counsel, research and engineering office, Logistics Management Institute and the individual service secretaries all are trying to develop policies for dealing with non-profit organizations. The Budget Bureau is also conducting a broad study in the same field by President Kennedy. The Budget Bureau says it is about its report by Dec. 1, but a spokesman said the findings will not be sent.

An Air Force Secretary Eugene M. Zerk, on Sept. 23 issued a policy statement for Air Force dealing with its non-profit organizations. Analysis Service, Myrie, Reed and Stevens Development. Statement is the first issued since the Defense appropriations committee ordered such policy guidelines in its report this year on the Defense Department's fiscal 1966 budget.

"The practice of government agencies contracting with various companies and organizations for technical management, scientific evaluations and other non-military and non-defense activities is increasing in a rapid rate," the committee report said. "The government is moving toward a chaotic condition in its personnel management because of this practice."

High Pay Scale

The committee expressed dismay at the high salaries paid personnel at non-profit corporations like those in the Defense Department, and said it would have limited salaries except "it was felt that such drastic action would bring about a change in vital activities, perhaps new under staff and could further cut down on their salaries." The committee said it would require new limitations, however, said the Secretary of Defense established a relative policy for dealing with non-profit corporations by the end of fiscal 1966. Budget committee was made to Congress.

Zerk's statement said "salaries paid perhaps the most difficult problem of all." It said Air Force non-profit corporations' employment policy

"must be matched by good personnel and training. These companies have no money to offset the market at every time. If the compensation paid by these non-profit corporations exceeds that paid by the government, it should be to cause private industry to reject, often such higher compensation."

Zerk's statement was designed to establish guidelines for dealing with Air Force organizations, and to provide defense officials with "a standard should be the rule," the statement said, "shows to such particular in contract clauses. Exceptions must be fully justified in fact."

Purpose of the non-profit corporations, Zerk said, "is to focus the nation's finest scientific and technical talents on selected and highly sophisticated tasks. They must not become government catchalls for projects which could be handled by industry. The able work of their industrial staffs must be preserved. In all other non-military research be interested in public confidence is to be maintained in this complex role."

The House Armed Services' Special Investigations Subcommittee said now plans to probe Defense contracts with non-profit corporations. One concern of the subcommittee is whether certain elements of the department are making military observation in wide areas on the stock market.

Zerk's trouble on this is he is directive in dealing "there must be no conflict between the public interests with which these non-profit corporations are engaged and the public interests of their members, officers, members of technical staffs and other personnel. Each corporation shall be required to provide and obtain suitable protection to this end."

Zerk said non-profit organizations deserve special treatment when it comes to retaining their staff. Since these corporations are engaged in the same business as companies to grow back into research programs Zerk said that fees could be employed to enable non-profit corporations to permit research new under staff and could further cut down on their salaries. Zerk said that fees could be employed to enable non-profit corporations to permit research new under staff and could further cut down on their salaries. Zerk said that fees could be employed to enable non-profit corporations to permit research new under staff and could further cut down on their salaries.

An Air Force should direct disposal of non-profit corporations' assets upon dissolution, the statement said. It said corporations should be provided for the

Groups With Varied Interests Deal With Pentagon

Groups which deal regularly with the Defense Department and the military service fall into three general categories—governmental activities where members are engineers, scientists or educators, trade and industry associations, and organizations with military members whose interests are connected with the military services, such as the Air Force Association, the Navy League and the Arm of the U. S. Army. They include:

- Aerospace Industries Assn. of America
- Air Force Assn.
- Air Transport Assn. of America
- American Assn. for the Advancement of Science
- American Chemical Society
- American Institute of Biological Sciences
- American Institute of Chemical Engineers
- American Institute of Electrical Engineers
- American Meteorological Society
- American Ordnance Assn.
- American Physical Society
- American Rocket Society
- American Society of Civil Engineers
- American Society of Engineering Education
- American Society of Mechanical Engineers
- Armed Forces Chemical Assn.
- Armed Forces Communications and Electronics Assn.
- Armed Forces Management Assn.
- Assn. of Missile and Rocket Industries
- Assn. of American Ballistics
- Assn. of Load Transport Officers

- Assn. of the United States Army
- Chamber of Commerce of the USA
- Defense Oceanographic Conference Assn.
- Electronic Industries Assn.
- Independent Air Center Assn.
- Institute of the Aerospace Sciences, Inc.
- Institute of Radio Engineers
- Independent Airlines Assn.
- Joint Industry Control Committee
- National Assn. of Manufacturers
- National Assn. of Professional Engineers
- National Aviation Trades Assn.
- National Federation of Independent Business, Inc.
- National Security Intelligence Assn.
- National Small Businessman's Assn.
- Navy League of the United States
- Quartermaster Assn. Inc.
- Reserve Officers Assn.
- Relevant Officers Assn.
- Society of American Military Engineers
- Transportation Assn. of America

U.S. Will Outline Impact of Arms Control

By Katherine Johnson

Washington—Opportunities for social and economic advancement that would be opened through general disarmament, both within the U.S. and worldwide, will be outlined in the first comprehensive U.S. governmental evaluation of the impact of arms reductions to be submitted to the United Nations Dec 15.

The report will warn the disruptive effect of shifting resources from industry to non-military production, but this problem will be minimized as temporary.

Administration economists point out that the military requires approximately only 9% of the nation's \$515 billion annual gross national product.

According to U.S. estimates, the dollar value of the Soviet Union's military output represents that of the U.S., but accounts more than 18% of the Soviet economy.

The U.S. report was requested by the UN Secretary, directed under a resolution of the UN General Assembly to make a worldwide study of the social and economic impact of general and complete disarmament.

The Secretariat, which has estimated world armament expenditures at \$123 billion a day, at \$16.5 billion a year, appointed a six-member Consultative Group to handle the study. The U.S. is represented on the group by Winthrop Loomis, professor of economics at Harvard University, the Soviet Union by V. Y. Abolov, deputy director, Institute of World Economics and International Relations, USSR Academy of Sciences. Other members are from Great Britain,

France, Czechoslovakia, Poland, Pakistan, Venezuela, India and Sweden.

At its first meeting in Geneva in August, the group drew up its request for detailed information and submitted it to UN member nations. The information is to be based on the assumption of "complete and general disarmament under effective international control," which has been accepted as the goal of the UN under a General Assembly resolution.

The group is to start its evaluation of the tabulations in January. The requests for information covers three areas:

- Assessment of the release of resources now supporting military demands—manpower, primary materials, productive capacity and imports.

- Choice of uses for released resources—expansion of productive capacity, new educational, scientific, and cultural facilities, increased social services, or patterns of life in underdeveloped countries.

- Possibility of conversion of resources from military activities—refining and absorption of personnel, conversion, adjustment, and construction of productive capacities, reconstruction of research and technology, changes in regional specializations within the country.

- Impact on international cooperation to lessen and maintain for underdeveloped parts of the world.

The U.S. report is being coordinated and drafted by the State Department Office of International Cooperation Affairs and the two-member Ad Hoc Committee on Disarmament Agency, which is still primarily in the staffing and organization stage. Specialized reports are being submitted by almost every department of government.

Meanwhile, U.S. Ambassador Adlai Stevenson and Soviet Deputy Foreign Minister Viktor Zorin, under heavy pressure from other UN member nations, last week renewed talks on the composition of a committee to draft a disarmament treaty—the immediate standing bloc.

The renewal of U.S.-Soviet discussions followed by one week a General Assembly resolution, approved by acclamation, urging this action and asking the two main powers to report on the progress before the end of the session, scheduled Dec. 18.

There are the key points in the Sept. 20 U.S. USSR statement of agreed principles which the drafting committee would accomplish.

- The goal is a program "which will ensure that disarmament is general and complete and will no longer be an instrument for settling international problems

and the program shall ensure that States will have at their disposal only those non-nuclear armaments, forces, facilities and establishments as are agreed to be necessary to maintain national order and protect the personal security of citizens.

- "All disarmament measures should be implemented from beginning to end under such strict and effective international control as would provide firm assurance that all parties are honoring their obligations."

The agreement on principles—although hailed by both the U.S. and the USSR as a major development—has not solved the fundamental difference in approach.

- The U.S. wants a combined step-by-step control of arms—starting with a ban on nuclear testing. U.S. officials fear complete disarmament in a twenty-year period after they point out that as long as relative military power is controlled and kept in balance, some deterrence relations must not involve great risk and probably less risk of violence than an unrestricted arms race. In a complete disarmament of arms, they note, a few undetected nuclear weapons and delivery systems could be detected.

- The Soviet Union wants quick disarmament by the mutual destruction of existing weapons in discussion. USSR officials have questioned a period of one or five years to achieve general disarmament. If their program for short-term disarmament of military power is accepted, the USSR has stated repeatedly it will "accept any control

Conversion Records

Monroe-Sheriff Union claims the conversion designed by Natick Research has an air war record. The vehicle (AW July 7, p. 32) recently lifted a payload of 9,000 lb. to a height of 6,200 ft.

The Sheriffs claim no helicopter has taken such a payload to a height or ceiling 6,200 ft. (2,800 meters). The flight broke records for lifting a conventional helicopter—6,000 lb., by lifting loads of 3, 5, 7, 9 and 15 tons. The record flight lasted 30 min.

Previous record for maximum load lifted by a helicopter to 2,800 meters or more was set Sept. 23 (AW Oct. 3, p. 72) by the Soviet Union's Mi-6 lifting one which lifted a payload of 10,100 lb. to 7,110 ft. 2 in.

Data on the conversion flight is to be furnished to Polaris Research Corp. Information will be according. The next test for the conversion will be duration flying.



Titan, Atlas Carry Varying Payloads

Two night launches Nov. 21 by an Atlas II missile from the 655th Aerospace Test Wing Patrick AFB Fla. flew 3,000 mi down the Atlantic Missile Range with an experimental target warhead. Scheduled to be flown aboard Atlas missiles to test each of the Atlas I and Atlas II missile systems to the Pacific, the two warheads target warheads in General Electric—will be flown aboard the Atlas I and Atlas II missile systems to the Pacific. The Atlas I and Atlas II missile systems to the Pacific. The Atlas I and Atlas II missile systems to the Pacific.

prepared by the Western powers."

Stevenson has interpreted the Soviet offer for unilateral suspension as a warning with verification of armament destruction—total verification of armaments being maintained in production. "No arm-

aments, weapons were destroyed, it would be the weapons which were left that would be retained as a military operation," Stevenson said in a UN speech.

Congressional Comment

Sen. Joseph Clark (D-Pa.) and others have urged that the U.S. "put the Soviet Union on the test" on this offer for arms. "We are in a position to say 'call their bluff, it bluff it'."

In opposing opposition under "arms control," the USSR contends that it would amount to legitimizing spying in a world still heavily armed and with nations still capable of aggression.

In addition to the agreement in principle, the UN drafting committee will first prepare proposals by the U.S. and the USSR for guidance. Each program is placed in three stages. The first is a comparison of the two

representations for the first phase.

- Strategic nuclear delivery vehicles. All such means would be destroyed and their manufacture discontinued under the USSR proposal. Under the U.S. program, strategic delivery systems would be reduced gradually, and production and testing would be limited or halted. Complete disarmament would not be accomplished until final stage of disarmament.

The USSR has protested that the U.S. proposal would weaken the non-Soviet offensive long-range power weapons—but have rather U.S. nuclear delivery systems stationed in areas covering the USSR.

- Military bases. The USSR would eliminate all foreign military facilities of any kind in the world, while the U.S. makes no provision for the dismantling or conversion to peaceful use of military installations until the second or third phase of disarmament.

- Force levels. The military forces of the U.S. and USSR would be reduced to 1.7 million men each under the Soviet proposal; to 2.1 million men each under the U.S. proposal.

- Conventional weapons. Armaments of "operational type" would be gradually reduced and their production limited under the U.S. program. Weapons and armaments retained by the reduction in the armed forces would be destroyed and military expenditures reduced during the first phase under the USSR program. Further reduction in conventional forces would occur in the second stage.

- Other points. States would be required to give advance notification of launches of space vehicles and missiles, together with the track of the vehicle, under the U.S. program. The USSR program would require that launches be accompanied by communication, including inspection of rocket sites.

World Speed Record Is Claimed by Navy

Washington—Navy claimed a world speed record Nov. 22 when USMC Lt. Col. Robert R. Johnson flew an F-4H Phantom II jet aircraft 1,606.147 mph over Patrick AFB at an altitude of about 45,000 ft.

The existing jet aircraft speed record is held by USAF Maj. Joseph V. Ragan, who flew an F-4C at 1,606.147 mph, Feb. 15, 1959. Data on Col. Johnson's flight has been submitted to the Fédération Aéronautique Internationale as proof for certification as a world record.

The Navy says the 1,606.147 mph average speed was achieved over a 20 mile course. Maximum speed during the speed run was 1,670 mph, the Navy said.

BULLETIN:

AeroShell Oil W becomes first fully compounded additive oil to win approval of every major aircraft piston engine manufacturer in the U.S.

Aircraft, large and small, have logged millions of flight hours on Shell's new additive oil—the first fully compounded additive oil approved by every major U.S. manufacturer of aircraft piston engines.

Here are answers to 10 key questions about AeroShell Oil W—how it helps keep engines cleaner, reduces wear—even extends periods between engine overhauls.

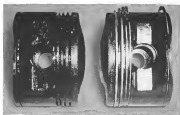
1. What type of aircraft can use AeroShell Oil W? **Fixed** engine planes of any size. Helicopters, too.

2. Why is it called a non-ash dispersant oil? Because, it contains special materials that help keep tiny, unwanted particles in the oil from clumping together and forming deposits. These particles remain suspended and dispersed.

3. How does this affect engine performance? It means that engine parts stay cleaner. That lubrication points get all of the oil they need. Your engine can run more efficiently, parts can last longer.

4. What about oil consumption? Because AeroShell Oil W helps provide a cleaner engine and less wear, you can expect less oil consumption.

5. Can AeroShell Oil W reduce maintenance costs? If you have been using a straight mineral oil, AeroShell Oil W can reduce your maintenance costs substantially. Interval between



Left: Pours from engine using straight mineral oil after 1,000 hours; note sludge and ash. Right: Pours from same aircraft after 1,000 hours on AeroShell Oil W.

engine overhauls can be extended.

6. How does this new oil respond from a cold start? AeroShell Oil W has an extremely high viscosity index. This guards against excessive thickening of the oil when cold, yet provides proper lubrication when hot. Results: fewer starting, faster warm-up.

7. Is AeroShell Oil W thoroughly proved? Thoroughly. It's had millions of engine hours of flight time.

8. Can AeroShell Oil W be added as a make-up oil? Yes. Its compatible with all piston engine oils now being used.

9. Is there more than one viscosity grade? AeroShell Oil W is available in three viscosity grades: 100 and 120 grades for large engines. And 160

grade for small engines where straight mineral oil grade 55, 65, or 80 is normally recommended.

10. Where is it available? At Shell Aviation Dealers everywhere. Any dealer will stock AeroShell Oil W if you ask him.

Technical bulletin on AeroShell Oil W will be sent at your request. Write: Shell Oil Company, 50 West 30th St., New York 20, N. Y.



A BULLETIN FROM SHELL—where 1,367 scientists are helping to provide better products for our energy.

British United Airways, Cunard Win 22 Routes Competing With BEA's

By Herbert J. Coleman

London—British's two major independent airlines—British United Airways and Cunard Eagle Airways—last week were awarded 22 routes in competition with state-owned British European Airways, BUA and Caledon Airways, but to direct services, most of appeals.

The 22 routes, mostly to Europe, were granted by the Air Transport Licensing Board in the midst of a preliminary investigation of a petition by British United Airways and Cunard Eagle Airways to the independent Council of Airports (AW Nov 27, p. 31) by Minister of Aviation Peter Thompson.

Newest competitive licenses granted are to:

- British United Airways, to Paris, Amsterdam, Zurich, Rome, Turkey, Genoa, Milan, Athens, Barcelona, Palma, Malaga and Lisbon, Madrid.
- Cunard Eagle Airways, to Glasgow, Edinburgh and Belfast from London, to Dublin from London and Liverpool, to Nice from Manchester and Birmingham, and to Casablanca, Copenhagen, Stockholm, and to Vienna.

Licensing Board made one route restriction for seven routes, starting Apr. 1, 1965, to allow BEA a year's operation without diversion of traffic by the independent.

In the Cunard Eagle route, the significant routes are within the United Kingdom, along a BEA stronghold. As other United Kingdom route was awarded to BUA from Glasgow to the Isle of Man.

In all, the Licensing Board turned down 36 other routes requested by the independents. But the closing concerns of the licensees did not cause without incident, but pressure to Thompson's overruling of the board on the Cunard Eagle route.

This occurred when British United's presentation team, headed by counsel David Gosselin, walked out of the licensing room and withdrew its application to serve Calcutta, Freetown and Lagos.

Gosselin referred to the minister's acceptance of British Ocean Airways Corp. evidence that the state-owned airline had financial commitments for aircraft to cater to the North Atlantic routes for five to six years, and reported.

"The very fact that BUA is at this point, the whole proceedings of the independent companies before the board has been frozen."

He also said that it was really in the

process an civil air transport after charges that the Licensing Board is favoring in total uncertainty after its latest ruling.

The decision, which has caused widespread criticism from the British press and independent, has been long awaited since under the Air Transport Licensing Act of 1960, the minister is given final power of decision. In effect, it is a decision to award (AW Mar 22, p. 31) with absolute license to two routes over any third license. Because the act was designed to give order competing airlines to British independence, Thompson's ruling came as a surprise.

Thompson, referring to BEAC, said the independent's losses this year will be about \$30 million, due partly to lower by subsidies and subsidies, partly to re-organization problems after Caledon 1 decision (BEAC carries a recommended deficit of \$12 million this fiscal year), partly to strikes and importantly to traffic recession and overcapacity.

The latter problem, Thompson said, "was particularly acute in the North Atlantic, where the traffic slump caused the companies to reduce the number will have a very difficult time next year."

He denied that BEA and BEAC held a monopoly on world routes and stressed that whatever the future may hold, there are now more tests than passengers.

He said that under government policy, the independent must be run profitably and not just maintain the operations of the line.

Turning to his position under the act of 1960, Thompson noted it gives the minister a dual role, one is final court of appeal and another is representative of the public with other countries, noting the minister has to consider very carefully how he will sign here and what point he will ultimately have to go to.

Thompson also extended that it is not the intention of the act to promote competition between British carriers for its own sake.

As for the Cunard Eagle decision, the minister announced:

"I would not say that the decision is applied in no way implies the slightest loss of confidence in the Air Transport Licensing Board for from it. The act, however, never provided that the board, the commissioner and the minister must in all cases agree."

Other factors in the Cunard Eagle case, he noted, was BEAC's capacity to carry the traffic, evidence that BEAC intends to cut in North Atlantic capacity this year, the weakening Atlantic travel market and the probable effects of international negotiation of traffic rights.

El Al Financing

New York—El Al head, Aronson, is negotiating with the Export-Import Bank for the financing of two new aircraft. Boeing 700s to be delivered in March and May.

El Al, Shimon Lohat, executive vice president of the airline, said that he anticipates no financing difficulties due to the carrier's high creditworthiness. Last year the airline's operating loss was \$1 million (AW Nov 6, p. 32).

Lohat said that the addition of a third Boeing 700-420 this spring will enable the carrier to increase its transatlantic service during peak summer months from an average New York-Tel Aviv flight to 16. The 700s will be used to augment the British Overseas Airways line flying from Tel Aviv to Istanbul, Tehran and Athens.

Lohat said he does not expect the 700s to replace the Boeings in any foreseeable future.

The Israeli carrier currently is negotiating new route structures in Africa. As yet, said Lohat, with "no expert to which month either in July or West Africa but not in both simultaneously."



Inventory Management Simulator program at... Clark Equipment...improves customerservice...with less inventory



■ High-capacity memory Two IBM 308 Data Processing Systems with RAMAC have 71,000 replacement and repair parts in Clark's Chicago parts warehouse.
■ The simulator kept the facts. As soon as shipments arrive at the warehouse, an operator using this remote display station sees the loading orders, facts and from the computer's video screen (left). ■ Customer service first. Using this remote display station in the sales department, the operator gets information from the same place while the customer is on the phone.

Clark Equipment Company has presented a computer program called an Inventory Management Simulator. The program allows Clark management to study the possible effects of decisions on future customer service and future warehouse profitability. When management gets the computer's report, it was a position to make new rules for the operation of its parts warehouse.

Here's what's happened since Clark put the new program into operation...improved customer service...practically eliminated back-order problem...reduced the pathway time for issuing material by more than 50 per cent...reduced emergency order shipping time by 80 per cent...enabled a physical inventory to be taken without any interruption of service to customers.

Availability highest ever. Inventory management is a complex job at Clark. Its Chicago warehouse is one of the busiest and largest in the country. Before the Simulator program was developed, the warehouse carried an inventory of 85,000 individual replacement and repair parts. Use of the program helped transfer the investment in inventory to those parts most frequently called for, giving high availability with less investment.

Management Operating System.* Clark installed two IBM 308 Data Processing Systems with RAMAC. These computers store, update, and offer on an instant's notice information on almost every aspect of the warehouse operation. Including complete information on every one of the 71,000 items maintained in stock.

Now, Clark is assured of maintaining just the

right level of stock for each item. The program's formulas, developed from the Inventory Management Simulator, even recommend how large a purchase order should be placed for each item and where it should be placed.

If you have an inventory problem, why not consider a simulation program? You don't have to have your own computer. We can apply you with an Inventory Management Simulator...you can read time on a computer. Results...improve the profitability of your warehouse operation.

*A Management Operating System uses IBM computers to make complex business decisions and make better management decisions. This program is the most powerful of its kind. It can be used to solve a wide range of business problems. It can be used to solve a wide range of business problems. It can be used to solve a wide range of business problems.

IBM
DATA PROCESSING



The Boeing 727: a versatile, short-haul profit-maker

The new new Boeing 727, now entering production, is a versatile aircraft designed to operate profitably over routes segments ranging from 150 to 1700 miles.

The 727's low operating cost will enable it to produce a profit at almost any stage, even with modest load factors. Yet its generous cabin space (70 feet and 113 feet per passenger) results in reasonable economy on high density routes, comparable to that of the largest jumbo.

The 727 will be a rugged jet capable of handling frequent landings and takeoffs. A 7000-gallon fuel capacity, plus

high allowable landing weights, will enable the 727 to make frequent stops over a long distance without refueling. This and other features, such as an integral passenger stairway, will minimize service time during stops.

The 727's quick takeoff, fast climb and near-400 mph speed will result in block speeds never before attainable in short-haul operations.

Already, 117 Boeing 727s have been ordered by American Airlines, Eastern Air Lines, Lufthansa German Airlines and United Air Lines for delivery beginning late in 1963.

BOEING 727

Fuel Line Investigated in Vertol 107 Mishap

Snapping of a fuel line is being investigated as a possible cause of the fire following a landing gear collapse which last week damaged beyond repair a Boeing Vertol helicopter undergoing hard landing tests at Mojave Field, Palmdale, Calif.

Two test pilots aboard the 107 were uninjured after the left landing gear failed and the result. The aircraft was participating in its Federal Aviation Agency certification program and one of the pilots was an FAA representative.

It is too early to determine what about the accident test fire on the 107's crash, a Vertol spokesman said. Most recent vibration data target in the defense program was No. 15, but this already had been postponed to Dec. 19 because Vertol said of weather conditions during certain scheduled test periods.

The incident is still under investigation, but indications were that the fire resulted from a leak in the intermediate fuel line between the aircraft's two landing gear pods, which carries the fuel to the engine. It appears it is in the fuel line that can be made to prevent a reoccurrence of the failure.

The pods also contain electrical services, but Vertol said only indications are that fuel no relation to the fuel system. The aircraft was moving after it hit the ground and the question now lies how could be fixed.

Failure of the gear itself, Vertol said, apparently occurred, as it is on the delay since at this time, two tests in course of design tests. The test was during the test was over hours last night. Apparently, the also number did not fail, but part of the landing gear support structure.

The aircraft was the No. 1 production model, and belonged to the manufacturer. Second order 107s are engaged in the FAA certification test program. New York Airways had ordered to get the first of its 107s into scheduled service early next year.

Initial Government Funding Seems Assured for Supersonic Caravelle

Paris-Brussels government ministers reportedly have agreed to provide various initial financing for Sud Aviation's medium range supersonic transport project, the Super Caravelle.

The intergovernmental committee, part \$125 million in 1962 budget to get the project under way. In a recently announced French law near completion, total cost of developing the Mach 2.2 Super Caravelle is estimated at \$250 million. Government expects to be the project during the life of the plan (1962 through 1965) are estimated at \$161 million. French economy plan states that if the project is undertaken in 1962 as it now apparently will be—the first prototype will fly in 1965 and initial production models of the transport will be available in 1968, in about three years of service. U.S. Mach 2 projects.

Foreign Aid Bought

The French, of course, are hoping to get foreign backup—technically, financial and industrial—for their supersonic transport project. Sud's current agreement with Douglas Aircraft, however, only covers the subsonic Caravelle. Douglas participation in Super Caravelle development will require a new agreement.

Sud already is working on an agreement with British Aircraft Corp., though at yet this agreement does not concern the Super Caravelle (AW Nov. 6, p. 40). But experts, however, that eventually BAC will come into the Super Caravelle project. If not Sud will go it alone, at other points with the private French economy. Ascent Doreville, which is working closely with Sud on the Super Caravelle.

French airlines sources point out that France already is spending \$350 million on City Douane-Maguy IV two-jet bomber which won't make any money for the country. Thus, this financing gap, France can afford to spend \$250 million to produce the Super Caravelle, a supersonic transport which might prove to be a commercial bonanza.

Government decisions backing Sud's supersonic project was based on an aircraft manufacturer Super Caravelle model first revealed during the Paris Air Show last June (AW June 3, p. 40). That model was designed to carry 70-80 passengers. The present 100-passenger Super Caravelle—which has no design resemblance to Sud's subsonic Caravelle—has been fired up around the following characteristics:

- Double S-wing line with low wing-loading, engine nacelles under the leading edge.
- Four 25,000-hp thrust Bristol Olympus type turbojets with partial afterburning and thrust reversers. Sud is in-

sured in under U.S. engines but to date has been supplied by U.S. aircraft and type. In any case, the power plants will permit Super Caravelle cruising speed up to Mach 2.2.

A Takeoff weight of 100,000 lb. Passenger capacity is fixed at 395 with a seating layout of two by two and a seat pitch of 37 in.

Price of 100-passenger Super Caravelle has not yet been fixed. In its earlier, 70-80 passenger configuration, Sud was working with a price of \$5-600,000.

Company officials insist, however, that the Super Caravelle's wing will be a semi-rigid wing much the same as its subsonic Caravelle.

Design Problems Eased

The more significant task before the government in seeking financial support of its project was that the Super Caravelle model put France into the supersonic transport business before any other country. In order to get the blueprint, the French have not followed U.S. and British design projects which center mainly around the Mach 3 ages.

In carrying out the Mach 2.2 Sud has discarded as too costly, reduced work of the technical difficulties connected with supersonic transport development.

The Super Caravelle, for example, will be built with standard lightweight metal alloys.

Engineers at Sud believe that their Mach 2.2 cruising speed is probably the thermal limit for standard lightweight metal alloys. It is not clear, but metal creep difficulties, however, and testing along this line is being pushed. France, moreover, has Mach 2 plus speed experience since Dassault Mirage IV. Since in this speed range for nearly two years.

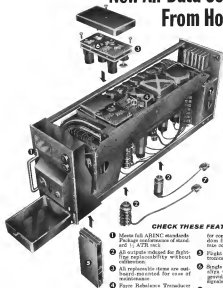
Sales Arguments

Sud's sales arguments will include the claim that the Super Caravelle could be operated under current air traffic control rules and thus will not need special ATC procedures which Mach 3 aircraft will require.

Sud also emphasizes supersonic concept involves overnight flights between U.S. East and West coasts. This 2,100-mile range may even be extended to California routes which will require somewhat more time. The idea here is that Sud, operating its next supersonic transport years before Mach 3 aircraft are ready, wants to tap as much of the supersonic transport market as possible.

And officials, of course, realize that the actual costs pattern for the Super Caravelle is not too cost prohibitive, but rather rivals the Chicago-San Francisco or New York-Miami.

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Civil Aviation in Australia and New Zealand: Part II

Airline's Growth Perils Australian Policy

By L. L. Doty

Melbourne—Steady expansion of Ansett ANA, privately-owned Australian airline is creating a competitive imbalance in domestic routes that threatens to undermine the government's overall policy of economic stabilization.

The government is already expanding serious doubts over the effectiveness of its policy (AWN Nov. 27 p. 16) which calls for controlled competition between Australia's two domestic trunklines, Ansett ANA and the government-owned Trans-Australia Airlines (TAA). Ansett ANA's progress is exceeding its rate, which has been set by the past three years has brought about a competitive distortion that should totally confound these doubts.

TAA is saddled with a route system that, for all practical purposes, is rigidly fixed. It is unable to expand its non-competitive route system in any significant degree because, outside of Queens land and Tasmania, it lacks inter-state operating rights. Within the past year it has been lacerated with competition on two formerly non-competitive major routes, which makes their operation economically marginal for the government-owned trunkline.

Ansett ANA, on the other hand, has gained a substantial advantage over its competitor through the purchase of its all-Australia non-stop feeder lines. As a result, Ansett ANA now has a non-competitive route system twice the size of that operated by TAA.

Business of the feeder system Ansett ANA is in a position to divert local intra-state traffic, transferring it to trunk lines, from TAA to its own services. Its means in meeting capital requirements of schedules with TAA in the Tasman. After Sydney, Melbourne is next to have a dispatching effect on TAA.

Entrance of Ansett ANA on the Port Moresby-Lae and Lae-Rahol routes both the highest traffic density routes in New Guinea, made further cuts into TAA's gross revenues.

Ansett Empire
Ansett ANA is controlled by Ansett Transport Industries, which is headed by Reginald Miles Ansett. Miles' vision of aviation and other transportation in Australia. In addition to the airline companies it operates, Ansett Industries operates some 250 motor coaches and cars in Australia, a fleet of trucks and trailers for freight and a hotel system accommodating over 1,500 guests.

In the aviation field, Ansett is an intense eye beyond a purely domestic operation. It is no secret here that he has long dreamed of an oceanic route, but tentatively in the southeast Asia area. He holds an interest in Cathay Pacific Airways of Hong Kong and in South Pacific Airlines of New Zealand. He has made steps toward a Tasman Sea operation.

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Ansett's success in taking over the airline, Ansett Transport Industries in 1977, securing control of Under Air Transport after a court fight and the subsequent absorption of the small feeder lines has brought accusations of monopoly against him. In addition, the government has often been accused of granting Ansett favors that would lead to a monopoly.

Earlier than this, the government of Prime Minister R. G. Menzies was accused by the Labor Party of granting Ansett its attempt to purchase West Australian airline companies of the Ansett-owned feeder line in New South Wales. East-West turned down the Ansett bid last year but its president, R. Shand, holds that he has been unfairly treated by the Department of Civil Aviation into accepting the offer.

The government has repeatedly denied the charges and Ansett counters them by openly suggesting the government's dual airline competition system on domestic routes and its persistent subsidizing the two enterprise system. Ansett supporters point out that Ansett earned its present position through public support that his airline eventually makes steady on TAA's traffic.



First RAF Comet 4C Flies

First of five de Havilland Comet 4C transports for Royal Air Force is shown on its maiden flight from company's Chertsey production facility. Airplane, powered by four Rolls-Royce RA5 Avon turbojets, will be equipped by RAF Transport Command. Ansett is fitted with seats for 54 passengers and can be converted to carry 12 stewardesses and 5 bunks, with room for 47 persons.

AIRLINE OBSERVER

- **Look for action** after talks between **Canada Eagle Airways** and **British United Airways**, the two largest British independent airlines. Initial carriage negotiations may have been prompted by failure of **Canada Eagle** to win transatlantic operating rights.
- **On-time departure** record of the airlines may be loaded for a ground drop because of growing antipathies between the carriers and their general maintenance personnel. At least one major union has advised its members to follow company maintenance manual procedures to the letter, regardless of any verbal advice to the contrary. For phrase explained by the union: "It 'do not be concerned with a tick.' A recent notice added that 'bureaus lives depend on your work... as time departs do too, but they can wait.'"
- **Watch for the Federal Aviation Agency** to circulate an internal directive that, in effect, will approve parts of former Administrator E. R. Quisenberry's plan to transfer the authority of the agency's Research and Development Service Agency (RD-1), a controversial order issued by Quisenberry last 11 but never implemented, gave the service power to identify "the need for modifying or replacing planned and installed air navigation traffic control, communications and related equipment, facilities and systems."
- **Early indications** are that November traffic on domestic headlines will show an upward trend.
- **Strongly worded statements** have been filed by **Alitalia** and **Scandinavian Airlines System** with the Senate Commerce Committee's aviation subcommittee (AW No. 27, p. 50). SAS bluntly charges the Air Transport Act which SAS says is supported by Pan American and TWA, with saying an "intensive campaign of propaganda and pressure tactics" against foreign flag carriers. The airline said the campaign is based on "misuse and distortion" of arguments designed to show that U.S. carriers are "being used in the public interest" and that foreign airlines are "predatory and evil."
- **Planned demolition** of a new London Airport Authority to take over main operation of the city's international airports from the Ministry of Aviation may be delayed up to a year because enabling legislation has not yet been written. The authority was recommended by a parliamentary select committee on estimates (AW Aug. 7, p. 43).
- **National Flight Data Center** is scheduled to begin operation early in 1962 under Federal Aviation Agency's Air Traffic Service. TWA will also authorize standards for automated flight data produced independently by U.S. Coast and Geodetic Survey, the military services and several commercial firms. Long-range FAA plans call for "a coordinated worldwide network" of such centers to serve U.S. and international aviation.
- **British Airways** has asked its petition for subsidy on its international routes after the Civil Aeronautics Board denied the original request. The Board based its decision on grounds that British failed to "set forth a detailed economic justification..." at the start and added that petition which are "deficient" will be denied "without leave to amend."
- **Board has denounced bilateral air transport agreements** with The Netherlands, Switzerland, Norway, Sweden and Denmark, on grounds that also because of terms call for negotiation.
- **San Francisco and Oakland Helicopter Airlines** (AW Oct. 16, p. 15) has instructed its pilots to report periodically local weather conditions and submitable traffic pass observed during flights for use by local radio stations. The program has provided the carrier with a substantial amount of protection at little or no cost.
- **U.S. and Iceland** last week opened talks on an amendment to the bilateral air transport agreement between the two countries. U.S. is seeking rights to move Dublin with limited rights to London and European ports of call.

SHORTLINES

- **Alitalia reports** it has revised its sales representation by designating six sales locations in North America and one in Central America. Regions and their headquarters are: Eastern, New York; Midwestern, Chicago; Central, Cleveland; Southern, Miami; Western, Los Angeles; and Canadian, Montreal. No executives were present to treat local executives.
- **Delta Air Lines** has begun weekly round-trip service between San Francisco and Caracas with Convair 440 jets. Flight makes stops at Dallas, New Orleans and Montego Bay, Jamaica.
- **Eastern Air Lines** will serve Trans World Airlines flights at Washington, N. Y., Atlanta-Baltimore-Easton, Roanoke and Wilkes-Barre, Pa., beginning Dec. 15. TWA and consolidation of ground services at small airports having low frequency schedules will save money and it is in line with recommendations made by Civil Aeronautics Board Chairman Alan S. Boyd (AW No. 6, p. 17).
- **Initial decision** of CAB chairman at the suspended Puerto Rico Line competition concludes that the present fares of Eastern, Pan American, and Trans Caribbean airlines between New York, Newark and San Juan and Miami San Juan for first, second and third class be allowed to stand—and that the jet schedule be dropped.
- **Longer for first-class passengers** has been scheduled for Eastern Air Lines' conference at Atlantic City, Miami and Atlanta airports. Children's meals, radio, television, telephones, and desks will be provided along with food service and soft drinks, and alcoholic beverages will be sold.
- **Pacific Northern Airlines** reports a net income of \$186,413 for the first nine months of 1961—a 154% increase over the \$159,185 earned during the same period last year. Total revenues for the first nine months of 1961 increased 9% over the same period last year.
- **Pan American World Airways** and Middle East Airlines, the Lebanese flag carrier, have agreed to provide representation and sales facilities for each carrier in certain of the other's major markets. The agreement gives Pan American a link with Middle East's routes and provides the Lebanese carrier with sales offices in North America, Asia and the Pacific.



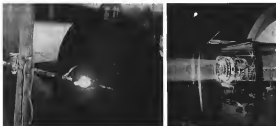

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ACTIVE ICBM defense techniques now under investigation include use of microwave energy to produce plasma discharge (left) with the objective of producing warhead lighting failure. Another approach under investigation uses particle stimulation, results to ion engine down (right). These and other active ICBM defense weapons concept studies are part of Project Defender.

U.S. Increases Radiation Weapons Studies

By Philip J. Klaus

Washington—United States is stepping up the pace of its research on active weapons, basically referred to as "Newweapons," as a possible defense against ICBMs. These bear a slight resemblance to the "death ray" concept of science fiction.

Much of the effort centers on plasma, one of the oldest yet least understood electrical phenomena. There is strong evidence that similar work is an old way in the USSR, aimed at the same objective.

Most of the brand new research is far in X weapons as the U.S. is open under the Advanced Research Projects Agency (ARPA) as part of its Project Defender program. Current budget for Project Defender is about \$300 million annually.

But a number of organizations and companies, unable to obtain Defense Department support, are carrying out modest research programs with their own funds.

Raring as understaffed research through the present state of research suggests that any effective ICBM defense using X weapons probably is at least five years away, and perhaps a decade.

The U.S. effort is like an iceberg in that only a small fraction of the total appears above the surface of public awareness.

Here are a few examples:

- **Rose Air Development Center** in Mojave was working research and development research for "continued" investigation of energy transfer and ionization processes in plasmas for nondestructive and non-lethal experiments under the defense weapon laboratory program. In 1971, the Contract Research Department daily in support of government planned project ARDC is conducting its own in-house experiments in the use of microwave radiation to produce plasma (AW Oct. 23, p. 18).

- **Air Force Cambridge Research Laboratories** recently announced plans to build a \$830,150 process physics research facility which will be used to explore "communications blackout due to plasma sheath or nuclear electromagnetic emission control of atmospheric ionization waves, weapons feasibility and power coupling and transmission effects," according to the AFRL announcement. The first three labs represent replacement for ICBM defense. The new facility slated for completion next fall, will be able to generate high level RF power across the spectrum from UHF to 140,000 mc. At 1,000 mc the facility will be able to provide more than 10 kwatts.

- **Raytheon Co.** last spring secured an Air Force contract for study of high

energy spherical plasmas, under direction of the company's Dr. Paul A. Slichter. In response to an Air Force White paper, a Raytheon spokesman declined to provide additional details because of military security. However, several months before the contract award, Slichter submitted a paper to the Journal of Applied Physics, published in January, 1969, entitled, "On the Question of Ball Lightning." In the article, Slichter discusses a theory advanced in 1954 by Dr. Peter L. Kapitza, one of the USSR's top physicists, to explain natural ball lightning. At that time, Kapitza suggested that the phenomenon might be produced artificially, using radio frequency energy.

- **USAF's Lt. Gen. Roscoe C. Wilhoit**, testifying before the House appropriations subcommittee on Apr. 16, 1969, in response to a question from Chairman George H. Mahon, said "The Air Force funds an ongoing aviation research in the possible use of radiation energy as the lethal technique in an Air Force weapon." That is believed to be a reference to an Air Force program with Vane Manufacturing of Garland, Tex.

- **At ARPA's ICBM defense** concept team, held in February, 1969, Dr. Arnold T. Nordmark, presented a paper entitled "Particle Accelerators and Radiation Weapons." Although the conference itself was classified "secret," the program listing the paper by title was unclassified. At that time Nordmark was

a professor at the University of Illinois, but recently left to become director of the National Specular Department of General Motors Defense Systems Division in Santa Barbara, Calif.

Current emphasis on "Newweapons" stems from U.S. studies of the ICBM defense problem over the past several years, with some additional impetus provided by recent statements by USSR Defense Minister Rodion Yakovlevich that the "Soviet Union has solved the problem of anti-missile defense."

These studies indicate that if defense is based on interception by a missile during warhead reentry, the Soviet Niko Zvezda probably is in good approach to use fully to be almost of five times.

Cost Is 'Staggering'

Over the cost of implementing a Nike Zeus type defense is sufficient strength to protect uranium and provide an effective defense is staggering. Some estimates range as high as \$50 billion.

ARPA is funding feasibility studies of another approach to ICBM defense, known as "beam weapons" (see sidebar, this issue), which would use the ionizing power of high energy beams, such as those of x-rays, gamma rays, or electron beams, to destroy the warhead. Such beams would be directed at the warhead, and the ionizing power of the beams would be sufficient to destroy the warhead. Such beams would be directed at the warhead, and the ionizing power of the beams would be sufficient to destroy the warhead.

However, the cost of building and placing thousands of such weapons in orbit, and replacing them knocked down by enemy countermeasures, appears to be as high as to place the whole concept in question to the opinion of some top Defense Department officials.

There are none of the considerations that have focused interest in the more exotic types of weapons.

If the idealized "death ray" of science fiction were achievable, it would offer several important advantages over Zeus and Slichter concepts. Because such a "ray" travels at the speed of light, there is no need for complex ground-based computers to predict future intercept position of the warhead, and to calculate guidance commands for the anti-ICBM missile. For similar reasons, target lock would be almost instantaneous, making the attack difficult to evade. There would be more time, increasing the probability of destruction.

The most likely candidate for the death ray role has, until recently, been high power microwave radiation. There is no question that presently available megawatt-level levels of power can heat and perhaps even melt portions of a warhead. Extensive research must be done with current high power technology as the Ballistic Missile Early Warning System (BMEWS) is poised now in operating and maintenance personnel.

But the use of high power microwave

radiation to destroy or destroy an ICBM warhead, which is designed to withstand the extreme heat and shock of reentry, is a far more difficult problem.

At warhead reentry intercept altitudes of 100 mi. or higher, the power level of a ground-based radar beam is heavily attenuated and dispersed. For example, the largest spherical radar antenna ever built in the West, measuring 1,000 ft. in diameter, has under ARPA sponsorship, will have a beam width of 1/6 degree at its operating frequency of 430 mc.

At an altitude of 100 mi., the beam energy would be distributed over a circular area 3,500 ft. in diameter. Even if the frequency were increased by a factor of 10, the beam width of that attack still would be 100 ft. At higher frequencies needed to compare the beam further, the power available, from either side of proportionately, so there is no net gain in energy concentration.

Lower Possibilities

The advent of the optical wave (laser), with its inherently small beam width and narrow bandwidth channel, has raised the possibility that it might eventually develop levels of energy concentration needed for use as a possible death ray.

The recent Defense Department survey of 49 top electronic industry scientists and executives, seeking their views on this most important area of research

some research (AW Oct. 23, p. 51), ended, some of the following comments.

- "A significant amount of attention is being given to our laboratories to research in . . . generation of coherent radiation and optical and infrared spectrometers. The availability of coherent techniques at these wavelengths . . . may lead to opportunities in more weapons."

- "The ability of the optical wave to transfer efficiently optical energy into the energy of a single optical line makes it possible to concentrate the coherent coherent light to a far focus and . . . by concentration of its subsequent of energy, even the destruction of even metals."

- "Focused electromagnetic or particle energy . . . is still in the feasibility study category where if at all but not been proven either feasible or advisable. However, if large amounts of energy can be focused on distant points in space, we see a long way toward being able to . . . destroy objects in space." The General Electric scientists are reported to have achieved power levels of as much as one megawatt in a laser for a brief successful test. But considerable work remains before the energy level needed for optical lasers reaches values which would qualify it as a potential weapon by itself, most obviously before.

Additionally, there is the problem of attenuation and scatter of optical waves



Satellite Simulator Cushioned on Hydrogen

Simulation for testing of missile stabilization and control systems, developed by Minneapolis-Honeywell Associates (Minneapolis), is being carried out in a new facility at the University of Illinois. The facility consists of a 100-ton cushioned platform, supported by 100-ton bearings on cushions of both porous hydrogels.



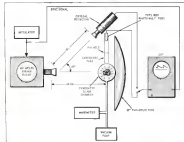
THERMOPLASTIC RECORDER/DISPLAY SYSTEM

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At 40,000 feet and higher a pilot could spot ground-level targets no larger than a tank by using a new recorder/display system developed by General Electric's Light Military Electronics Department. A photographic view is obtained from side-looking radar, recorded on thermoplastic tape, and displayed accurately on a screen in the cockpit. Requiring no cathode ray tube, the screen has variable brightness that permits operation in ambient light, without the use of a hood.

At extreme heights—or in space—the system is capable of providing great detail and a permanent data record of TV, infrared, or any other "eyes" of the vehicle. Combined or composite displays are also possible for integrated display applications. The thermoplastic recorder/display system is a typical example of LMED contributions to progress in aerospace electronics.

GENERAL ELECTRIC
Light Military Electronics Department
1000, New York



EXPERIMENTAL ARRANGEMENT used by Boston Research Laboratories to produce plasma discharge in low pressure air, employ low power X-band radar and ultra-parabolic reflector to focus the microwave energy into partially-evacuated glass chamber.

concept, as it passes through the atmosphere. This is particularly severe if the laser output is at infrared wavelengths. If the device were carried by a satellite and operated only in space, this problem is avoided. But the world needs another problem—providing sufficient electric power aboard the satellite.

The general consensus of most observers is that even if it were possible to apply high-level electromagnetic energy directly to an ICBM warhead, there is no guarantee that this is still could destroy or deflect the warhead.

Use of Plasma

Thinking has now shifted to the idea that perhaps the use of microwave energy, as radiation from an optical source could be used in combination with plasma.

A plasma is a collection of neutral and charged particles and ions, extremely well kept moments of equilibrium in the natural energy levels of the particles. The air lamp, used for many years to provide an intense source of illumination, produces this phenomenon by creating a plasma containing ionization particles vaporized from the electrodes.

For ICBM defense, the plasma might be the one which surrounds, and surrounds, provides, a body neutralizing the strength at high speed. If this plasma energy can be harvested or focused to deflect or destroy the warhead, using natural electromagnetic energy provided by ground (or satellite-based) radar or laser beams, the ICBM defense problem is solved, at least as theory.

Research at the warhead shell center

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Individual unit assembly is first step in an advance element. Here four 4 pole antennas enclosed in ground screen are being connected in one end of Foamflex feed line. Special Phelps Dodge connectors are used to link the lines to the guides and four way power dividers.



Completed quadrant elements, ready for placement on antenna mount. Each quadrant is later assembled in exactly the same manner.



Completed quadrant elements are raised to platform for placing into position on pedestal mount.



An example of a corner element and how it can be inserted into the Avian-Bogner array. This element forms a separate unit that can also be used as a portable ultra high frequency antenna.

Foamflex® Coaxial Cable helps put and keep this advanced antenna system on the track!

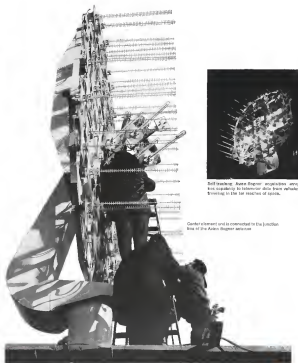
A feed network of 34", 50 ohm Foamflex coaxial cable is a critical part of the fully automatic Avian-Bogner acquisition and tracking antenna that represents an advance in the state of the art. The efficient operation of this sensitive antenna is greatly increased by the low loss, high phase stability and electrical uniformity of its weatherproof Foamflex feed line assemblies. Special connectors, designed and fabricated by Phelps Dodge, link the Foamflex lines to double-tuned, strip-line, four-way power dividers in each quadrant element of the antenna.

Designed for Edwards Air Force Base, this modular array is assembled from identical quadrants, each equipped with power dividers, dipole antennas and capacitor elements. In contrast to the heavier, fixed-type paraboloids, the lighter, smaller Avian-Bogner model costs less, yet has high acquisition capability for

telemetry information through the use of three automatic tracking modes. Quadrant elements may easily be replaced when changes are desired in frequency bands, due to the simple design and construction of this antenna.

The feed system was planned, fabricated, calibrated and installed by A-T Electronics, New Haven, Conn. Accuracy of electrical length for each cable was maintained from cable to cable within one degree at 2300 megacycles after bending.

The outstanding qualities of semi-flexible, aluminum-shielded Foamflex have been proved in a number of applications where low loss, long operating life and a low noise to high signal level ratio are essential. If your specifications call for a coaxial cable of the highest efficiency, we recommend you investigate the capabilities of Foamflex.



Self-tracking Avian-Bogner acquisition array has capability to intercept data from vehicles traveling in the far reaches of space.

Center element and is connected to the junction box of the Avian-Bogner antenna.

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plasma engine. Presumably such weapons could only be used in space, where there is no atmosphere to deflect their beam of high-speed particles.

Earlier this year, General Electric Technical Military Planning Directorate (TEMPO), at Santa Barbara, Calif., awarded a contract for \$729,686 for "conducting of investigations of the feasibility of developing the use of ion beam projectors." The contract, from Air Force's Air Force Ground Center, Elgin AFB, is one of several applied research programs sponsored by AFOSR in extreme ion mechanisms in search of advanced weapons for strategic defense. GE and at the time both GE-TEMPO and AFOSR are on ARPA's list of Project Delicate contractors.

Airfield research effort in civilian cooperation is under way at Electro-Optical Systems, Inc., under Office of Naval Research contract as part of Project Delicate.

Soviet Efforts

The interest of U.S. scientists in man-made lightning bolts stems from translations of a number of papers on the subject by key Soviet scientists which appeared in their literature in the late 1940s and mid 1950s. One of the earliest Soviet papers was by Dr. George I. Rukh, in "Elektricheskoye Dazhiganiye," published in 1947 in the USSR journal of the Institute of Electrical Engineering.

But it was Soviet Academician Kaprin's 1955 paper on ball lightning that really triggered interest of U.S. scientists who were following the Soviet literature at that time. Within several years Soviet had authored additional articles speculating that man-made lightning bolts, produced by ion tapping located from ground-based radio, might be used for defense purposes.

Two of the U.S. scientists whose curiosity was aroused were Dr. Silberg and Donald J. Rutledge, at the time co-workers at Melpar. Silberg subsequently joined Rutledge and Rutledge moved to the Radar Research Laboratory, Ann Arbor, Mich.

Rutledge is author and compiler of a recently published book, "Ball Lightning," which contains translations of seven important articles on the subject by Soviet scientists, including Kaprin and Rukh. The 78-page book also contains an introduction to the subject by Rutledge and an extensively annotated bibliography of 83 important papers by scientists of all nations. "Ball Lightning" is published by Plenum Press, Great Neck, N.Y. 11565, 227 West 17th St., New York 11, N.Y.

More than 40% of the articles on ball lightning listed by Rutledge are by Soviet authors.

Significantly, the number of Soviet articles has tapered off sharply in the past several years, corresponding to the approximate time that U.S. scientists began publishing articles which concerned the Soviet work.

It was he were concerned, but the Soviet press reported the death of Rukh from myocardial infarct at the time of Premier Khrushchev's visit to the United Nations in New York in the fall of 1960. At the time Soviet writers were hoping that a major spectacular was in the offing, which never materialized. Lack of details on the cause of Rukh's death has led to speculation that it might have occurred in the course of an experiment with artificial lightning bolts, perhaps even a downburst-type, made, as indicated in a Soviet newspaper.

The natural lightning bolts which have caused the concern of scientists occur, subsequently, results after the same thunder type of lightning bolt discharges in a downburst. Based on reported observations, collected by Dr. J. R. McNally, Jr., of Oak Ridge National Laboratory, the lifetime of such lightning bolts appears to range from a few seconds to many minutes. Rutledge reports in his new book.

The fact that observers report that such bolts occasionally disappear explosively, suggests that sufficient energy is stored in the bolt, perhaps as much as one million joules, according to Rutledge. Depending upon whether multiple ionization occurs, Rutledge estimates that a ball may contain in diameter would have stored energy equivalent to between 0.6 and 60 ft of TNT.

Shock Wave

From recent measurements of the low-pressure of a stroke of natural lightning made by scientists at the USSR's Leningrad Physics Institute, using a figure of about 20,000; Soviet scientists have estimated that the pressure in the shock wave produced by such a discharge can exceed 1,000 psi, double that of a lightning bolt with a diameter of 1 cm.

To explain the formation of a lightning bolt, Soviet Academician Kaprin postulated in 1955 that the energy required to create the plasma comes from intense radio waves produced by an external source. One possible source, Kaprin speculated, might be the ionization produced by a lightning bolt which would precede the formation of the ball.

Kaprin suggested that his theory be evaluated in a laboratory experiment using a powerful source of radio waves in the decimeter range, focused into a small space, to attempt to produce an ionospheric discharge. Under these conditions, the discharge "should grow into a luminous ball with a diam-

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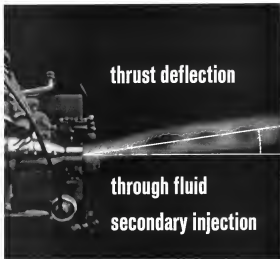
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mer approximately equal to one-fourth the "available" of the solution. Kapteva observed, theories conflicting with those of Kapteva have been advanced by other scientists, both in the U.S. and in the Soviet Union.

An article which appeared in the Oct. 10, 1968, issue of *Kosmos* (USSR) by A. Yarov, reported that experiment for producing artificial ball lightning had been developed, using a quartz tube with a special profile and with a heat-resistant non-conducting cone which emits electric arcs. When the thermal dissociation and ionization processes have been completed, the air is suddenly cooled, causing a luminous ball approximately 1 cm in diameter through the outlet of the tube.

The article concludes with a statement which suggests that the experiment has objectives far more important than merely watching scientific miracles. "However, the method is considered to be of only theoretical interest since the overall efficiency is low, i.e., the consumed energy is much higher than that released during the explosion."

U.S. Experiments

Similar experiments have been carried out in a number of U.S. laboratories, including those at Ames Air Research Center, Ames Research Foundation and Bendix Research Laboratories. Bendix scientists in a computer-aided effort used an X-band airborne radar transmitter capable of producing 21 peak power and about 30 watts average power. Using a paraboloid to focus the X-band energy into an evacuated sphere, Bendix scientists produced a lightning-like ball of plasma.

However, it did not contain visible secondary injection ball, which came out, in several important respects. The magnitude of the ionization was much smaller and there were no pulsations known at work to hold the plasma together, as appears to be the case for natural ball lightning.

A theory that suggests that ball lightning is not a plasma phenomenon has been advanced by R. A. HIL of the University of Minnesota School of Physics. HIL hypothesizes that the ball lightning is a space containing a "vortex" inhomogeneous distribution of space charge in the form of a highly ionized gas, the ionization being produced in molecules from within a few electrons. HIL suggests that ionized material such as dust, water vapor and combustible gases may play a significant role in its behavior.

The previously cited Soviet article by A. Yarov explains the capture of space charge in the form of a highly ionized gas, the ionization being produced in molecules from within a few electrons. HIL suggests that ionized material such as dust, water vapor and combustible gases may play a significant role in its behavior.

other substances, which accelerate the transfer of energy to free electrons of the surrounding air.

Still another theory, advanced by Charles M. Henshaw of Ames Research Foundation, suggests that there may be two distinct types of natural lightning ball phenomena. One, with an energy level of less than 0.1 joule per cubic centimeter which follows the normal parabolic path, and another with higher electrical energy level, which behaves differently. Henshaw has proposed a model to explain the behavior of the higher energy type.

Henshaw's theory, which he considers speculative, suggests that plasma with greater energy density than the parent lightning strike may be generated through ionization-resistance local or turbulence immediately following a lightning strike could treat the column of ionized air like an up scale into a loop, resulting in a configuration conducive to forming a plasma ball.

The theory also postulates that the ball is produced from ionizing its high internal energy in an ionization field in a buffer zone of cool ion and electrons which is contained in the intense magnetic field of the plasma shell. Approximately a very high, Henshaw and his colleagues have sought government support for a program to investigate the feasibility of generating ball lightning in a free space.

Ultrasonic goal was the production of artificial lightning balls for ECM detection. The ARF concept proposed the use of electromagnetic waves having suitable combination of their electric and magnetic field vectors. It was based on previous work in ionizing charged particles in certain solid dielectric media.

If the concept proved feasible, two or four pairs of earth-based antennas whose beams converged in space could be used to produce an artificial lightning ball. By changing the frequency and/or moving the radio beam once the ball had been formed, it should be possible to accelerate the plasma up to relativistic speeds in less than a second. ARF scientists operated the ARF program's hypothesis that considerable research was required before the feasibility of the concept as an ECM defense could be determined.

For unknown reasons, the study and experimentation program proposed by ARF did not receive government support. Although the amount of funding needed was only about \$100,000. Nevertheless, a Bendix proposal to research the characteristics and applications of the space "nucleation" discharge has not received government funding. One possible explanation is that similar work was already under way at other facilities.

A simple device which produces



Pilot Locator Beacon

Pilot locator beacon, which continuously transmits emergency signals on the military distress frequency of 121.5 mc, when a pilot displays his parachute in pull-out warning ring, is being used by the Navy by George Blanton Co., Inc., Northridge, Calif. Beacon, including battery pack weighs less than 1 lb., so product detectors have for maximum periods up to 14 hr. even a single up to 100 mi. The coded net measures 1 in. x 1 in. x 1 in. and its signal can be picked up by standard VHF receiving equipment.

diagonal shaped plasma, called spherical plasma, and anode-cathode, anode-cathode, then to speeds at least 400,000 mph, has been reported by W. H. Bortol, currently with the Stevens Institute of Technology. The Institute also is a contractor to ARPA on Project Defender.

Bortol used two diagonals made of ionization ions which determine atoms had been absorbed. A current of several thousand amperes was passed between the electrodes for an interval of about one-half second, equivalent to an energy of about six joules. (This is the amount of electrical energy required to light a 100-watt lamp bulb for one second.)

The current discharge causes evaporation of ions and electrons from the electrodes, forming a plasma which is pushed into a slender column by the magnetic field produced by the discharge current. This slender column of plasma bends, breaks apart and forms into a diagonal-shaped blob of plasma which then moves away from the electrodes at speeds up to 120 miles per second. Bortol reported.

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(Continued)

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► **Radio Propagation Course Scheduled**—National Bureau of Standards course in radio propagation will be given at its Boulder (Colo.) Laboratories, July 16 through Aug. 5. Course is open to scientists concerned in industry, universities and government agencies.

► **New Thermoelectric Material Developed**—A germanium-selenium alloy, which has exhibited conversion efficiency of 9% and is expected to reach 15%, has been developed by Radio Corporation of America. New thermoelectric material appears best suited for operation in the temperature range of 500C to 1,000C, but can be operated at low potentials up to 1,500C, compare says.

► **NAA Expands PERT Use**—North American Aviation's Space and Defense Systems Division will use PERT (Program Evaluation and Review Technique) for all major contracted and all house program contracts has announced. First use of PERT will be on the Saturn S-11 booster program for the National Aeronautics and Space Administration. Company also will use PERT "as a basic planning, evaluation and control system for all future major development projects," it says.

► **High Temperature Piezoelectric Crystal Developed**—Process for treating quartz crystal which enables it to oscillate with great stability at temperatures as high as 590C has been developed by Bell Telephone Laboratories. By subjecting quartz crystal to an electric field of about 500 v per centimeter for a period of 24 hr at a temperature of 590C, separates are swept out of the crystal enabling it to subsequently oscillate with little energy dissipation at temperatures of 590C BTL reports. When crystal waves are cut from treated blocks at angles of rotation greater than 10 degrees, the crystal exhibits extremely stable oscillation characteristics, BTL says.

► **USSR Studies Piezoelectric Polymer**—Recent Soviet literature suggests the possibility of producing new type of piezoelectric material using polymers such as polyethylenesulfonate, polyacrylonitrile, polypyrrolidone, polyvinylcarbazole by adapting solid films made of double polymers to a constant electric field. Writing in July-August, 1961, issue of *Kristallografiya* I. S. Rea speculates that certain substances may be found with a variety of combinations of piezoelectric, ferroelectric, piezoelectricity and semiconductor properties.

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THREE HAWK MISSILES are moved to launcher and loaded, ready for firing, by tracked loader/transporter vehicle.

Army Hawk Anti-Aircraft Missile—Part I:

Rapid Tactical Mobility Stressed in Hawk

By David A. Anderson

Andover, Mass.—Army's Hawk anti-aircraft missile system, developed as a high-volume production at Raytheon Co., is well into its second year of service with 15 Army battalions deployed in West Germany, the Panama Canal Zone and the island of Okinawa in the Pacific.

U.S. Marine Corps fielded its first Hawk system more than a year ago, using a "single-loader" launcher concept that isolates all components air-transportable by helicopter.

Within the coming months five NATO members—West Germany, Italy, France, Belgium and Holland—will activate a total of 32 battalions among them.

Hawk—which conveniently is an acronym for *Howe's All-the-Way Killer*—is being developed and produced under a prime contract between Army's Boston Ordnance District and Raytheon Co. The Northrup Corp. is the single major subcontractor, but the system draws on components manufactured by about 1,100 source suppliers.

Tasked direction of the program is the job of Army Research and Guided Missile Agency, working with Raytheon's Missile and Space Div. at Bedford, Mass.

From exclusive details and photographs of the Hawk system at a field

level are produced here, a second article will describe production of the weapon system at Raytheon's Arm/Weapons division.

Primary mission of the Hawk system is defense against low-level attack aircraft. Post-shooting has generally limited this task to areas of advance planes and satellites from ground level to about 1,800 ft.

But Hawk capabilities have been stated by military sources to cover a much wider range. Here, they can engage targets diving at speeds up to Mach 3 at altitudes from ground level to 18,000 ft. They point to successful intercepts by Hawk's tactical aiming element—Jules, Little John, and Corporal—to emphasize that quick response of the Hawk system even when the target is supersonic and has a small radar cross-section. Little John, for example, is just over one foot in diameter.

Tipped targets launched in Hawk during test firings at the missile development program included an AQ-1 drone—but at a speed of 1,400 mph above about 10,000 ft—and a QF-106 drone, engaged at less than 100 ft altitude.

Major characteristics of the system, its ability to maintain a high rate of fire against single, massed or widely spaced targets.

The low-altitude capability of Hawk originally led to Army plans to use it as

a weapon, complementary to Nike Hercules for area defense. Hawk would engage low flying attackers, while Nike Hercules would take on the high-altitude targets. But the Joint Chiefs of Staff rejected the idea soon after 1974, and since then there has been no work on fixed-site variations for Hawk.

Instead, Hawk is a full-mission weapon, designed to be rapidly and easily transported by a variety of current cargo aircraft, helicopters or wheeled vehicles. It can be set up anywhere that provides line-of-sight between its radar and the missiles or their launchers. No prepared sites are necessary, and the web permits site-to-site mobility. The battery has rolled into positions to level the various tasks and in the cables connecting power supply to the components of the firing section.

Each Hawk battery consists of two firing sections, each composed of a single launcher control station. The launcher has two acquisition radars. One of these, the AN/MPQ-15 pulse acquisition radar gives coverage of long range, high-altitude and large-volume targets. The other is an AN/MPQ-34 air-seeker radar for picking up targets past results at shorter range.

Both these radars feed target information to the battery control station, where targets are identified and selected for action from a conventional plan



HAWK battery equipment includes AN/MPQ-34 air-seeker radar (above) and AN/MPQ-15 air-seeker radar (right). Three Hawk launchers ready for transport in a unit to batteries are mounted on pallet attached to chassis trailer (below). Cargo beam has been added to loader (lower right).



position indicator (PPI) presentation. Each of the firing sections is tied to battery control through its AN/MPQ-34 or its element radar, which receives a target number from battery control and then searches in an elevation line to find and lock on the target. After lock-on, the search procedure continues automatically.

Each firing section has three launchers, each preloaded with three Hawk missiles. The battery control station receives information in a display which tells the status of each missile. Battery control then selects the missile to go. The missile looks at its target, which is illuminated by the air radar, and also looks at the element radar's radiation.

When the target is in range, the section operator in the battery control station fires the Hawk. Its own guidance system solves the intercept

problem during the flight out and directs the missile to the target.

Normal operations of the Hawk system are under the direction of fire crew, which the unit has been trained. These fire positions or the battery control station, include the tactical control officer and his assistant, who work from a mission indicator display of the local area.

Crew Functions

These men identify and select targets for the missile system.

The air acquisition radar, which picks up low-flying targets while radar on towers from ground clutter and slow moving traffic, is operated by a third man. The two remaining men sit at two consoles, one for each launch section and observe target displays. They finally fire the Hawks when the surfaced

target comes within striking range.

Tied into the control station is the crew chief distribution box, which intercepts the lines between the air observation radar of each firing section and the Hawk launchers. The crew chief can use this box to remove any launcher on his screen from action for reloading in case of malfunctions. This box also is the terminal for telephone lines between battery control and the target handling crew and firing crew on the same contact if necessary.

Barely completed is the battery post described by five officers and 65 men, that organization is the one being used by U.S. Army Hawk units. But the Marine, with a different emphasis on use of the weapon during an assault operation, have chosen to operate a "single-loader" Hawk system that is completely transportable by helicopter. This basic change sets out the target





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components of the system, such as the battery control circuit, in favor of smaller and lighter units.

Heart of the Manassas system is the AN/TSW-4 analog fire control console, a 419-lb. unit that can be brought to the site by helicopter and man-lifted into fuel position if necessary. The unit functions as the battery control circuit. But because that is a stripped-down system, the Manassas Hawk batteries do not have the large pulse capacitors that, instead, they work with the on-board capacitors and a single on-board capacitor and a single firing section of three launchers.

Even this system can be reduced one step further by eliminating the acquisition radar in the acquisition phase; then, it will be as good as go-looking for targets—that'll be them. For that minimum aircraft weapon, a single launcher is held to the assault fire console console through the crew chief data-bus system and a single on-board capacitor.

Hawk batteries which will also serve with NATO countries will use a table of operations like that of the Army batteries. One of the major criteria for the NATO Hawk system is that all components be completely interchangeable with those for the U.S. Army system, so that logistics and operations within the NATO area are simplified.

System Design

Land-based equipment for Hawk design, other than those systems determined by the system threat was that the system is to be capable of being easily transportable in container and airborne vehicles. This meant that even though had to be used to minimize dimensions and weights yet still be consistent with the Army's concept of field operations. Both Army and Manassas specified that super-wheeled units

had to be able to float. For the Army, the most serious loading restriction was that the Manassas, as one vehicle said, "If everything else fails, we want to be able to put it down on the launcher and have less trouble the thing when it's there."

Further requirements for the Hawk system were determined by Army policy on field maintenance. There is no doubt the time and the place to perform maintenance work, however simple or system components in the field, was the Army. Therefore, less assets in operations and cluttering gear had to be based on small light modules that could be found from their chosen by a quarter-ton of a handle, pulled out and replaced with a new one within seconds.

Environmental Stresses

Army field operations imply rugged terrain ranging from deserts through rain forests to Arctic tundra and polar ice caps. The stage of environmental conditions impact the expected requirements on a weapon system designed for Army use. Hawk is expected to use the same kinds of environment as a land weapon or a half-tracked vehicle.

The transfer in an expanded to work, other than beyond beyond, great power during movements over open terrain, soaked with water while crossing a flat or dropped off a moving track of an airborne supply point. After they enter the logistics pipeline, Hawk needs to be set up in open storage with out any extra protection, they can get stored in, covered with snow, painted with lubricants or shrouded by weathering. But the effect they go from there to the launchers for preflight check, that are expected to work. The also poses design problems.

More elements of the system is the Hawk vehicle, a short-wheel vehicle with a 10-ft front wheel. The Hawk body mounts a cruciform of four



Photo-Reconnaissance Pod Installed on CF-104

Prototype of a photo reconnaissance pod is installed on a Royal Canadian Air Force Lockheed CF-104 for flight tests in Palmdale, Calif., at an altitude of 30,000 ft. The pod and fighter. Pod contains a prototype MOCOM 71 mm reconnaissance camera system developed by Computing Devices of Canada, Ottawa, and W. Vickers, Ltd., London. English System is designed for low-level, high-speed reconnaissance.

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truncated delta across music surfaces, spanning 47 + 30. Weight all the complete music, such as live, a separate sample 1.28% to

A glass fiber radome of rigid shape forms the nose cone of the Mars Direct orbiter. The radome is a cylindrical section containing the cruise guidance package and the antenna power units. The radar dish is mounted at the forward end of the package and extends into the base of the radome.

The weekend compartment is located behind the gasoline section. Filled with lots a choice of weekends depending on the corrected thrust.

Rocket Powerplant

Fantasy sports, from the leading edge of the wings to the end of the tail cone is fitted by an Aerojet-General XM-22E8 solid-propellant rocket carried on a thin-walled shell made of 4130 steel. The rocket engine has two different propellants to provide two thrust levels for the missile. The boost phase delivers a high thrust for a short duration.

to accelerate the wedge clear of the launcher and to flight speed as rapidly as possible. The surface then tapers over and provides a lower thrust level until burnout or intercept.

smaller surface, with three distinct rows along horizontally structured components, skin and fittings. The wing skin is bonded from 0.85 mm, 7075 T6 aluminum alloy and bonded to the internal practice consisting of two thin metal ribs, two 0.003-in. (81 μ m) holes

These rivets are used. The wings and deconv are being delivered by Long-Tons Vought and Northrop, through the latter company which is Northrop's only major subcontractor.

Control acetamides and diuretics are presented in a small ring structure around the acetylcholine receptor of the vesicle motor axon.

Radiator production here takes out the radiator section, complete, with hose ends and eleven control rings. These are shipped in a standard container (30546762) to go either to a OEM unit or a repair unit or to the Radiator Assembly unit at the Army's Red River Arsenal, Tyler, Tex. At this site, designated HMMCCO for Heavy

pre-diagnostic treatment for cancer. Assembly and Model Check-Out: the complete Hawk brand is assembled with its Arrang-Global motor, the LTV/Neckup wings, and the green aerodynamic surface. After a check-out, the model is disassembled and transferred to its XMA-10 shipping and storage container for shipping either to a strong, area or a barrel side.

Parallel to the movement of the goods themselves, the various items of supporting equipment are sent to Ft. Bliss, Tex., where they are checked out as a matter of a Rafterian rite. From there, the Army takes over and ships them to a field unit.

At the finished site a Hawk roost is removed from its container to a hanging doll. Assembly of the wings follows. From there, the completed roost goes to a check-out area where 45 men of testing certify it as either

a go at a no-go round. From there, the truck can be sent either to a galler for storage or a lorry for road duties.

The XMH11 pallet is a simple truss-work structure that holds three struts at the same position as the bumper holds them. The pallet can be used under- or track-mounted, or stand free. Attachment points can be used for pickup gear or for helicopter slings.

These stacked NIMBLE loader transport clusters are assigned to each battery. These units can come from one to three modules from checkout and storage areas to the launcher, and load the rounds in a matter of seconds after arrival at the launcher.

The NM 7863 is a longly beamster is a wheeled, trailer-mounted unit that can be towed behind one of the 50 M35 cargo trucks assigned to each battalion. An electronic control system in the beamster drives it to the position prior to each parking before fuel data is fed to the crane just prior to bracing.

Mobile Rodgers

The big pole, acquisition table, over the unit weight limit for helicopter transport, is jettisoned so that the distended unit can be separated from its trailer and so-lifted under a helicopter. The parabolic reflexes bleed down into the arena for treatment.

The trailer and lighter on acquisition trailer is transported as one unit on its two-axled trailer. Like the push-acquisition trailer, it can be towed by

NOMINAL COMPOSITION							
	C	Si	Co	Mn	P	S	Cr
AL 25 Ni (250)	01	25	—	—	1.6	2	3
AL 30 Ni (280)	01	30	—	—	1.6	2	3
AL 18 Ni Co Mo 2500	01	08	7	3	4	1	—
AL 18 Ni Co Mo 2502	01	18	9	3	4	1	—

PRODUCTS	23°C 100°F	UTS 1000 PSI	Elong. %	RA %	Modulus 10 ⁶ PSI
SABS (Direct extrusion)					
AE 1.0 N (2.0)	280	24.8	12	8.0	1.1
AE 3.0 N (3.0)	310	24.5	12	5.5	1.0
AE 1.0 N Co Mo (2.0)	310	21.0	10	3.0	1.2
AE 1.0 N Co Mo (10.0)	900	30.0	12	8.5	1.4
SIBS (Cold rolled steel type)					
AE 1.0 N (2.0)	310	27.5	5	—	—
AE 3.0 N (3.0)	540	27.0	4	—	2
AE 1.0 N Co Mo (2.0)	260	29.0	4	—	—
AE 1.0 N Co Mo (10.0)	910	31.0	5	—	—

[illegible]

ALLEGHENY LUDLUM
PIONEERING on the Horizons of Steel



Second Mirage IV Prototype Makes First Flight

For photo of Eurosat Minsat TV-41 strategic header shows the actual Minsat TV prototype on its test flight. The aircraft is scheduled to fly the Minsat TV-41 which first flew in mid 1993. France expects to spend about \$200 million for 30 Minsat TV's; the satellite expects to have them operational in 1995. The two-stage launcher is powered by two Soyuzes. A four-shafting turboprop delivering about 13,000 ft thrust each. The aircraft gross weight is 31,000 lb and is designed to carry useful payloads of 1,500/2,200 lb at max. Mach 2.5. *Newsweek* volume is right on the left hand of www.nasa.gov.



WOULD YOU GET A BETTER GENERATOR —IF IT WAS NOT SHOP TESTED?

Yes... if it is tested on the stand used by many overhaul shops! The generator overhauls. The insulation weakens... potential trouble-free hours are robbed from the unit by standard procedures.

No... if it is tested on the Airwork modified stand. That black base in the lower right corner forced seating air to the field coils; provides the same volume of air the generator would get if it was operating on your engine under normal flying conditions. This holds the interior temperature within safe limits... keeps the insulation fresh... guarantees the long operating life built into the generator by careful Airwork overhaul procedures. A thermometer attached to the housing makes sure the operating temperature stays safe.

Even with all these safeguards, Airwork eliminates unnecessary hours on the stand. Most shops "mangle" the brushes from 7 to 12 hours so they wear to fit the cavities. Even after 12 hours, many brushes have only

a 50% contact area. This causes high altitude arcing.

Airwork uses an additional overhaul step that assures 95% of the brush area will contact the armature before test. Then the generator is motorized for a short 10-minute run before final test.

Like most of our test equipment, this stand has been redesigned to meet Airwork requirements. For example, it records field coil output at four points, instead of averaging their output at the usual two. The additional readings make sure all coils are working properly.

Even before the generator went on the test stand, it went through many Airwork extras, such as 2-plane dynamic balancing of the armature that eliminates a vibrating load from the brush rigging.

Every Airwork engine and accessory goes through a lot of extra steps that add up to greater reliability in service. In the long run, an Airwork overhaul saves you money, time and trouble.



**ESSENTIAL SERVICES
TO AVIATION**

Airwork
CORPORATION
Milville, New Jersey

kind an M16 power source vehicle. Finally, the air alternator motor—which is repositioned each by its two circular intakes—is also a single unit, mounted on a two-wheeled truck.

The AN/TSW-2 battery control central is a single chassis containing all the monitoring, plotting and fire control equipment. It is within the helicopter's weight limits.

Power supply for the entire battery comes from three truck-mounted 450w electrical generators. A fourth unit supplies power for the waste heat and check-out unit, a 400w generator is held in a spare. Two crew chief distribution boxes and 31 sets of electrical cable assemblies make up the rest of the power supply system.

Finally, a movable, trailer-mounted AN/MSM-45 organizational communications sleep goes along with each battery.

Part of the Hawk mobile system not attached to the batteries at the field site is a series of field maintenance shops, actually transported on a five-ton M16 truck to an ammunition supply point or a field maintenance depot. Each shop is graced by one specialized team of maintenance on the move.

Ready to roll, the Hawk battery system is a series of 33 vehicles which carry various components for two firing sections equipped with a total of 36 missiles. Overall system packaging and transport has been planned so that the system can be ready for long office studies after arriving at the battery site.

(This is the first of two articles on the Hawk mobile system. The second will appear in a subsequent issue of Aviation Week.)

PRODUCTION BRIEFING

Farnco Corp. of Newton, Mass., will construct a \$1,200,000 ft. Casco Plasma Research Building for USAF's Cambridge Research Laboratories at Hanscom Field near Bedford, Mass., under a \$634,158 contract. The facility, scheduled for completion in October, 1967, will accommodate production and diagnosis of plasmas, and protective experiments.

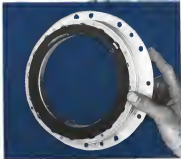
Lockheed P-1V Orion flew 7,547 mi. from Bedford, Calif., to Norfolk, Va., in 5 hr 48 min. with winds as high as 50 mph. Average speed was 491 mph. The plane loaded with enough fuel to continue in the air without human flight was made at 25,000 ft. altitude by Lockheed Test Pilot John Christensen. Plane consumed 415 mph against headwinds in the return trip. Elapsed flight time was 6 hr 5 min.

(Continued on page 97)

Now... Borg-Warner Mechanical Seals for Airborne Applications

Developed especially to meet the reliability requirements of airborne components, this new Borg-Warner Mechanical Seal combines compact size with lightweight metallurgy. Relatively new—yet this same basic design has been proved in almost every type of industrial and military shaft sealing job.

Borg-Warner Mechanical Seals are used daily under high pressures, for high or ultra-high temperatures, for seal losses, corrosion and volatile liquids, and even for radioactive fluids. Whatever your needs for sealing a rotating shaft, call Borg-Warner Mechanical Seals.



Special high-temperature seal design—seals up to 1500° F. and 10,000 psi.

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DIVISION OF BORG-WARNER CORPORATION
P.O. Box 3007, Torrington Avenue, Los Angeles 54, California
SEE OUR FILE IN SPECS DESIGN CATALOG—SECTION 40



Knowmanship in Action

Using hot gas to control SPACE VEHICLES

Designers can look to hot-gas and electro-geo techniques for special advantages in space and re-entry vehicle control. Chief benefits revolve around the extended temperatures of re-entry and the power benefits and reduction of nuclear propulsion.

Our research shows that—properly applied—pneumatic or gas jet thrusters can operate for long periods at the extreme temperatures associated with re-entry. Also inherent radiation resistance makes extensive shielding of the control system unnecessary when used with nuclear engines.

Increased simplicity and reliability also accrue because hot gas uses the propellant energy—in a **single conversion**—to control. This results in a significant weight reduction, too.

E-P concepts now under development aim at expanding the scope of hot gas technology into total space vehicle control. Already under construction for the USAF's Flight Control Laboratory, Aeronautical Systems Division, is a complete Hot Gas Flight Stabilization System. This system employs rotary actuators, reaction jets, control jet conversion gas control and computer computers, and is capable of operating for long periods at an ambient temperature of 1400°F. We will be pleased to demonstrate the feasibility of hot gas techniques as applied to your system requirements. Write us at Teledyne, N. J.

BENDIX COUNTDOWN FOR SPACE: ① Pneumatic Controls; ② Self-adaptive Control Systems; ③ Satellite Control and Stabilization; ④ Star Tracker Systems; ⑤ Spacecraft Rendezvous Computer; ⑥ Advanced Displays and Controls; ⑦ Liftoff, Approach, Landing



The Bendix® Rotary Pneumatic Servo provides a range of dynamic stiffness and provides with previous generation servos.

Eclipse-Pioneer Division



New Advances in Direct Conversion of Heat to Electricity

New advances in the direct conversion of heat to electricity, having important practical applications, are resulting from major development programs now in progress at General Atomic Division of General Dynamics in San Diego, California.

These programs include the development of compact, low-cost thermoelectric and thermionic devices for a variety of industrial and communications purposes, as well as advanced systems for space vehicle auxiliary power. Devices are being built which use solar and chemical heat sources, in addition to those using nuclear energy.

In addition to opening up new technological applications, these programs have also created unusual career opportunities for engineers and scientists with outstanding experience in the development of new products. These openings include several positions which are available for men having extensive backgrounds in both devices and materials.

Inquiries Invited from Engineers and Scientists

Inquiries concerning positions are invited from creative mechanical and electrical engineers, physicists, metallurgists and chemists interested in such fields as: high vacuum technology; the development of insulators, semiconductor-conductor bonds, thermoelectric materials; lubrication, high-temperature semiconductors, and the production of thermoelectric converters and generators.

In addition to opportunities in direct conversion programs, other openings exist at General Atomic for men interested in such areas as: solid state devices, converters, electromagnetic metal-forming machines, theoretical and experimental studies of very high plasma flows, dynamics of materials and structures under high impact loads, unconventional space propulsion systems, high explosive experimentation, and nuclear instrumentation.

Please address inquiries to Manager of Employment, General Atomic, P. O. Box 608, San Diego 12, California. General Atomic is an Equal Opportunity Employer.

Developments at General Atomic

Following are some of the recent developments in direct conversion programs at General Atomic's John Jay Hopkins Laboratory in San Diego:

- Tiny thermoelectric elements—tiny as dust at times smaller than other units with the same power output—made possible by the development of new high-strength, high-temperature bonds of semiconductor to conductors.
- New concept solar thermoelectric panels for space vehicle auxiliary power, being developed for the U.S. Air Force. Power systems using these lightweight panels are expected to have material weight and cost advantages over present solar cell systems.
- Thermionic converters, including early experimental units which have already produced over 50 watts of power directly from the heat of nuclear fission, at efficiencies of 30 per cent. Converters for electric power applications in the future being developed for the Rocky Mountain Pacific Nuclear Research Group and San Diego Gas & Electric Co. Converters for auxiliary space power applications being developed for U.S. Air Force.
- Compact low cost thermoelectric generators that convert gas heat to electricity. An experimental five-watt thermoelectric generator, designed for mass production, is being built for the American Gas Association, representing the U.S. gas combining industry.
- Thermoelectric units for refrigeration and air conditioning.
- Development of new high-temperature thermoelectric materials, including rare earth sulfides. Development of high-temperature thermoelectric modules for the U.S. Navy.



The left tiny thermoelectric elements developed by General Atomic for right solar thermoelectric panels for auxiliary space power. Bottom left module used thermionic converter and ion engine, experimental unit to convert gas heat directly into electricity.

General Mfg., Ltd., Sarnia, Ontario, a subsidiary of the General Corp., will supply the Canadian government with 60 ground support vehicles for Royal Canadian Air Force C7-19s under a \$1,780,000 order. Gas turbines produced by the General Corp.'s Allison Mfg. Div. at Arizona will be mounted on trailer type vehicles and will provide compressed air for engine starting and electrical power for ground electrical of various systems on the plane.

Telemetry and instrumentation equipment will be subjected to 1,100 shock tests during an aircraft test trip at the Atlantic Range Commission Test range, N.C., test range. The equipment will be installed in 155 air, duct and fuel tank engine engine tests. Testing will be conducted in the Lawrence Lake test of Sarnia Corp. The equipment to be tested run must under conditions or may be extended for later tests of tested aircraft weapons.

Midair collision study and simulation program to determine pilot ability to detect and evade a threat and kill will be chosen a suitable escape maneuver will be conducted in Space Group Co. at Federal Aviation Agency's National Aviation Facilities Experimental Center in Atlantic City. The program, funded by an \$85,000 FAA contract, will require a modified general trainer and flight simulator.

B. F. Goodrich Co.'s Aerospace and Defense Products Division will produce solid fuel motors for the Lulu space plane sounding rocket at its Ruston, Calif. solid motor plant, under a \$26,600 contract from the Navy. Delivery is scheduled for completion by the end of 1961.

Sub-Aircraft Co. of Sweden has received an order from The Netherlands government's and King school for five additional Sub 910 Sub training aircraft, bringing the school's inventory of Sub 910s to 31.

Chance Vought Corp. has been awarded an \$8,633,000 contract by the National Aeronautics and Space Administration for 14 additional four-engine Scout launch vehicles. This brings the number delivered or on order to 25.

Goodrich Aircraft Co., Alton, Ohio has received a follow on contract of \$1,417,479 from the Navy to furnish two F4U-2N weapons training trainers. The units will be used to train pilots in using radar aboard all-weather fighter aircraft.

SOME TIMERS DO ALL THEY ARE DESIGNED FOR—AND MORE. Others just make claims. A. W. Hayden's record speaks for itself. Behind each: 101 "pros" pooling their timing technology... sophisticated test labs to assure peak performance... built-in reliability reflecting years of experience. A. W. Hayden makes time all: timing motors, time delay relays, elapsed time indicators and the like—electronic marvels from Culver City, electromechanical wonders from Waterbury. Show us: chronometrically governed subminiature OC motor. Literature on request. When it comes to timing devices, for anything from data processing to satellite communications—miniature, subminiature or micro-miniature—specify A. W. Hayden, and be certain of peak reliability.



PERFORMANCE OUTWEIGHS CLAIMS

AWHAYDON
COMPANY
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GENERAL DYNAMICS | GENERAL ATOMIC DIVISION

Particle Accelerator Aids Space Research

Dallas, Tex.—Three-million-volt Van de Graaff particle accelerator is the heart of a \$278,000-plus test facility which Ling-Temco-Vought will use to conduct research ranging from basic nuclear interactions to space radiation effects on vehicles and systems.

The equipment, acquired to offer many times the capabilities of most accelerators now in use by U.S. industry and research establishments, already is proving its worth. Company officials indicate that the facility has a full workload of programs which will be enlarged with the addition of more equipment at the facility.

Major areas of research falling within the study capabilities include: neutron and positive ion cross sections, neutron radiation effects, space radioisotope simulation, radiation shielding, secondary radiation (Bremsstrahlung), isotopic production, electronic component radiation effects, nuclear radiation detection and space radiation detection.

Of particular interest to LTV scientists and engineers is the ability now to conduct in-depth studies of problems areas consistently with the actual design of space vehicles and systems. As one company researcher pointed out, time on nuclear particle accelerators is harder to get now than was the case with most fiscal years when that aerodynamic research tool needed its budget of dollars.

And, as LTV President Clifford K. Johnson pointed out, companies derive no longer any depend upon other sources for the required research, since each new design today is unique and it may even be the technical requirements dictate the research.

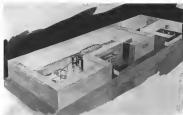
Projects under study here are as diverse as measuring the effects of secondary radiation on materials and components of SLAM (Supermaneuverable Landing Assist), the USAF-sponsored nuclear reentry program, to probing the possibilities of neutron radiation in activating photo-cells to produce electrical energy—a field of interest indicated by USAF.

LTV's new equipment, built by High Voltage Engineering, Evonox, Mass., will accelerate primary particles such as protons, deuterons, helium-3, alpha particles and electrons and will also produce secondary radiations such as gamma rays and neutrons.

It can produce 10^8 neutrons per second using a 20-MV (20 million volt) thermal yield exceeds 300 neutrons/gram/sec. Under negative operation, the



TARGET END of the Van de Graaff particle accelerator (background) extends from the particle generator system which is mounted in a gantry about approximately 12 ft. long and 5 ft. in diameter. Magnet system, between tank and target, selects type and energy of particle desired for a particular reaction.



NUCLEAR RESEARCH LABORATORY and test facility operated by Ling-Temco-Vought is built around three-million volt Van de Graaff particle accelerator. The facility now has a full workload and plans to increase the number of systems now being studied.

negatrons will produce up to one megarep of electrons at 1 msv. Gamma production exceeds 10^8 rads/sec for one foot from a gold target or in excess of that of a 50 kiloelectron volt source.

The accelerator's capability to produce other positively charged protons or negatively charged electrons makes it readily possible to duplicate the ionization of the Van Allen Belts, Ling-Temco-Vought technicians point out.

CHECK
YOUR
VOR SIGNALS
WITH
BENDIX
VOR-CHECK!



VOR-CHECK's accuracy is the new Bendix RVR-22 Navigation Unit makes it possible to check the accuracy of the VOR system in flight. A push of the VOR-CHECK button and the pilot knows if his own equipment is running "right" or "left."

The benefits: improved flight safety, increased pilot confidence and reduced maintenance costs (fewer units will be unnecessarily removed from the aircraft).

As you know, airborne VOR systems derive bearing information by measuring phase difference between two signals transmitted from a ground station. When the pilot pushes the VOR-CHECK button, the RVR-22 intercepts one of those signals, the other signal in this case is used to check both phase measuring circuits. The intercept and rectify in flight (4000 Hz) is a signal level is zero degrees valid. The Radio Magnetic Indicator reads zero degrees, and if the One Degree Selector is set to zero degrees, the Flight Path Deviation Indicator centers. An equipment failure would be detected and the amount of error visually presented to the pilot.

*VOR-CHECK circuitry is just one of the many features in the new Bendix RVR-22 Navigation Unit. It will be an optional feature on VOR-22A Navigation Units and use for radioaided VOR-22 series Navigation Units. Write: Avionic Products, Baltimore 4, Maryland.

Bendix Radio Division





BEECH Model 23 Musketeer lightplane's wings are constructed of bonded aluminum honeycomb. Aircraft has four seats.

Beech Schedules Four-Place Musketeer for

By Erwin J. Belben

Wichita, Kan.—New Beech Aircraft Corp. Model 23 Musketeer single-engine, four-place lightplane was unveiled here last week before key Beech retail and management officials.

The new airplane is designed to represent at least one-third of the total air fleet of approximately 13,500 airplanes in the \$10,000-\$12,000 price category. That business three-seater product will be delivered in the next few years.

The company announced that this newest and lowest-priced addition to its business aircraft fleet probably would be manufactured by Federal Aviation Agency and March and April delivery of demonstrators would begin in early fall of 1963. Prototype made its

first flight Oct. 23 flown by Beech Test Pilot Scott Telfer.

Significant features of the Musketeer include:

- Price of "approximately \$12,000"—reference is that the company is shooting to set the figure at just under this—which would include as standard equipment essential instrumentation for instrument flight and a Bend/Snell VHF transceiver; communications set plus an additional VHF receiver for emergency frequencies.

- Bonded aluminum honeycomb construction is utilized in the wings—believed to be the first application of this technique in a light business airplane.
- Completely detachable propeller having gear-actuated controls, providing for ease of access to both engine and

the forward portion of the airframe.

Prototype Musketeer has a four-cylinder Lycoming O-320-B2C engine, rated at 160 hp at 2,700 rpm, but indications are that through this may be the first choice for the production airplane. In itself, management still is negotiating with Continental on a possible substitute engine. Selected data mentions such an unnamed "160 hp, pressurized" Propeller is a fixed pitch 74-in. S-6000—large diameter type equipped with spacer. Fuel type is standard 91/96 octane.

Standard avionics accessories will include a 134 electronic system, but not, 15-watt generator, voltage regulator, low-voltage master avionics fuel pump, carburetor, induction air filter, exhaust scavenger and fuel and oil



MUSKETEER prototype is powered by a four-cylinder Lycoming O-320-B2C engine rated at 160 hp at 2,700 rpm.

1963 Market

feature. Main landing gear is fitted with hydraulic brakes.

Basic airplane is planned at a "ready-to-fly" price of equipment, with items listed as standard including ventilating, heating and defrosting systems, turn-coordinated front view-right left seat looking in any of five positions—and adjustable seat backs. Standard flight group will include wingtip, electrically operated, check, rudder clutch, turn-and-bank and outside air temperature gauge and a stall warning indicator. Standard engine compartment will include tachometer, engine shutoff of fuel and oil gauges and switches and engine primer. In addition to battery, hand parking brake, adjustable trim tab control, level, color, instrument and navigation lights also will be standard, as well as two vision,

air, rain and glass compensator. Options will include dual control system, vacuum system, gas heater and directional gyro, autopilot, ADF radio, communications kit, bonded paint table and external emergency landing.

Both management is specifically noting the Musketeer to be competitive with the Piper PA-23 Cherokee—which was the basic competitor in the prototype Model 23—and the Cessna Models 172 Skylark and 175 Skylark, and had clean lines, performance and color and accessories of these airplanes in general for its engineering department to consider in setting the new Model 23 Musketeer.

Price Advantages

But beyond attempting to gain the one-third share of the production market at present for this airplane, its price is expected to provide even larger long-range benefits for Beech. This will be

made possible because the price range of the Musketeer will enable the company's marketing organization to have considerable more dollars into its fold since the cost of getting started with a demonstrator of this type will be considerably less than it was with the firm's higher priced line.

Also important in modern marketing strategy is the fact that the airplane will make it possible for dealers to get customer prospects into the Beech "family line" rather than those flying Cessnas. It has been a basic fact in the business that it is easier to upgrade the customer pilot from one of a company's airplanes to a more expensive model later than it is to get him out of a competitor's product into your own. In addition, that later premium often means taking a competitor-made airplane in trade when it is accomplished.

Further, the Musketeer is designed for double flying characteristics and, with



AFT FUSelage consists of panel frames, wing spar and wing-fuel ducts at this. Metal honeycomb ribs extend half the wing chord and are bonded to the wing-panel skin and spar to provide long-life sections. The only rivets in this area being to attach the fuel tank adjacent to the fuselage. Rivet-like wingtips are reinforced by honeycomb ribbed ribs.



HIGH SEAT seating is slanted to main gear. Side tail is self-stow structure. Vertical tail is deeply built of two ribs, with upper structure with wing-mounted ribs. Seventh rib of Musketeer wing leading edge, due to use of bonded aluminum honeycomb rib, is shown right. Bonded aluminum ribs are fitted to prototype.



TOTAL PERFORMANCE

Total performance of your Gianni Controls airborne instrument or system has many phases. Designed-in function-effectiveness and long mean-time-between-failures. Production under a matured quality control system. Delivery on schedule in spite of last-minute changes. Flight readiness when received. Follow-up to integrate the product smoothly into your system. Ask the people on Titan, Atlas, FBII, Talon, Nike Zeros, Skybolt, Polaris, Discoverer, Mercury. You'll hear **When it's from Gianni Controls you get it on time, it works when you get it, and it keeps on working.**



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Raytheon solution for space

Recovery of space vehicles is a long range problem, commencing at atmosphere entry. Techniques for control from re-entry through touchdown, developed by Raytheon, are comparable to GCA concepts. Over the past two years, Raytheon has conducted a major and continuous investigation of the means by which a manned maneuverable space vehicle can be returned safely from flights in space to normal routine landing on earth. These investigations have included operational

control concepts, instrumentation, information flow analysis, basic system requirements and subsystem specifications.

Part of this effort was a space vehicle recovery study for the Air Force Flight Test Center encompassing vehicle energy management, glider characteristics, trajectory analysis, flight parameter accuracies, range instrumentation, navigation, communications, data processing display, and human factors.

vehicle recovery: LONG RANGE GCA

Other portions of the effort included earth return navigation and recovery studies for SLOMAR (as a subcontractor to the Martin Company), and joint efforts with Bell Aerospace Company on DYNASOAR Terminal Navigation Systems.

Currently, major emphasis is being placed on the APOLLO Ground Operational Support System (GOS3). This system will include global range instrumentation for tracking; telemetry and communications;

and control, display and computation centers.

One of the world's largest scientific-industrial organizations, Raytheon has proven capability to create the required technology and manage every phase of a space vehicle recovery system — from early study and design through development, production and field support of operational systems and equipment.

Executive Office, Lexington 73, Massachusetts

RAYTHEON COMPANY

EQUIPMENT DIVISION

RAYTHEON

Communications, Radar, Sonar, Guidance, Data Processing and Display, Countermeasures, Systems Design and Management, Basic Research



The world-famous **AEROCOM 1046 TRANSMITTER**

1000 W CARRIER POWER WITH HIGH STABILITY

The Aerocom 1046 Transmitter is designed to give superior performance for all point-to-point and ground-to-air communications. It is now in use throughout the world in climates ranging from frigid to tropical (operates efficiently at -35° to $+54^{\circ}$ Centigrade).

As a general purpose High Frequency transmitter, the 1046 supplies 1000 watts of carrier power with high stability (below $\pm 10^{\circ}$ Centigrade $\pm .003\%$ for telegraph and telephone. Temperature controlled oven for PSK). Multi-channel operation is provided on

telegraph A1, telephone A5 and PSK (Radio Teletype). It can be remotely controlled using one pair of telephone lines plus ground station with Aerocom Remote Control Equipment. Front panel switches and microphones are included for local control.

Four crystal-controlled frequencies (plus 2 closely-spaced frequencies) in the 2.0 - 24.0 megacycle range can be used one at a time, with channeling time only two seconds. Operation into either balanced or unbalanced loads. The power supply required is nominal 230 volts, 50 - 60 cycles, single phase.

The housing is a fully enclosed rack cabinet of welded steel, force-ventilated through electrostatic filter on rear door.

Telegraph keying (AD): Up to 200 words per minute. Model 1000 M Modulator (mounts in trans-

mitter cabinet) is used for telegraph transmission; a compression circuit permits the use of high average modulation without over-modulation. Model 900 4 Channel exciter is used for PSK.

Output connections consist of 4 insulated terminals (for Marconi antenna) and 4 coaxial fittings Type 80-336, which can be used separately or in parallel in any combination. For 600 ohm balanced load, Model TLM matching network is used, one for each transmitter channel.

As in all Aerocom products, the quality and workmanship of Model 1046 are of the highest. All components are conservatively rated. Replacement parts are always available for all Aerocom equipment.

Complete technical data on Aerocom Model 1046 available on request.

Also available—Aerocom Model 446 with 350 watts nominal carrier power and Model 100TFA—100 watts



EXPLODED VIEW shows sub-structural components of the Beech Musketeer.

Beech 23 Musketeer Performance*

Maximum speed at sea level at 7,500 ft.	345 mph
Cruise speed at 7,500 ft. at 75% power	318 mph
Cruise speed at 13,000 ft. at 55% power	328 mph
Range at 16,000 ft. at 55% power 140 gal. fuel	645 mi.
Range at 7,500 ft. at 75% power 140 gal. fuel	630 mi.
Range at 16,000 ft. at 55% power 100 gal. fuel	490 mi.
Range at 7,500 ft. at 75% power 100 gal. fuel	490 mi.
Rate of climb at sea level at 100 hp	700 fpm
Stall speed flaps down 10 deg.	48 mph
Takeoff distance over a 50 ft. obstacle	1,030 ft.
Service ceiling	15,500 ft.
* Performance estimates based on actual flight tests. Based on gross weight of 2,300 lbs.	



Write For This Free Catalog!

- 2 superb, fully illustrated books on our exclusive equipment for Private Wings Sportsman, Junior and Novice Air Science students
- Only One
- Quality Call Letters
- Special Rate Tables
- Competition Rating
- Recreational International Training
- Private Network

A-T ELECTRONICS, INC.
14 E. Grand Street
New Haven 8, Conn.
Exclusive distributor of
Parker Brothers' Grand Game,
See page A-27

PROBLEMATIC RECREATIONS 95



The first expenditure to Marston dated only the name of a clockmaker. The expenditure was able to translate a Marston equation as follows:
 $50^{\circ} - 50^{\circ} + 125 = 0 + 125 = 125$
This was strange mathematics. The value $x = 5$ seemed legitimate enough but $x = 0$ seemed some explanation. If the Marston number system developed in a manner similar to ours, how many fingers would you say the Marston had?

—THE BENT OF THE BENT PI
Diving through the two new catalogs from our Trans Dream we came upon large numbers of transformations of all configurations and characteristics. We suggest you think about it, too, if you're an application for them. Ask for Catalog TB-62, Industrial Transformations and Catalog TV-62, Replacement Transformations at Trans Transformer Corp., 4035 Redwood Ave., Venice, Calif. To phone for them, call Uptown 9-5381.

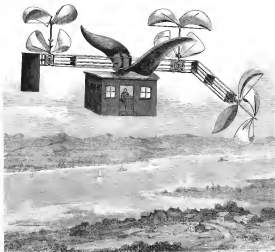
ANSWER TO LAST WEEK'S PROBLEM: Bob bent Al by 9-944, etc.

LITTON INDUSTRIES, INC.
Beverly Hills, California



3090 S.W. 37th AVENUE

MIAMI 33, FLORIDA



Nickel would have helped create a helicopter in the horse-and-buggy age

When W. J. Lewis conceived this 100-mph flying machine in 1875, he did so in an age that lacked the machines, methods, and materials to make it a reality.

But today, visionary designs are being transformed into practical realities on a virtual day-to-day basis—thanks to advanced technology and modern materials which possess exceptional combina-

tions of physical and mechanical properties.

For example, you might require an alloy casting for highly stressed conditions at temperatures as high as 1900° F.

To solve this problem—and many others requiring good combinations of the physical, mechanical, electrical, and chemical properties—look to alloys containing nickel.

We'll be happy to send you, without obligation, engineering data to help you select the best material for specific aerospace applications. Write to Inco Application Engineering, outlining your requirements.

THE INTERNATIONAL NICKEL COMPANY, INC.

87 Wall Street, New York 9, N. Y.

Inco Nickel makes metals perform better longer

Musteketeer Dimensions

Wing span	33 ft.
Chord	52.71 in.
Arched section	61.42/45 ft.
fuselage (nose)	3 ft.
Tail	2 ft.
Swamp	2 ft.
Deborah	6.5 ft.
Tiger nose	11
Aspect ratio	7.8
Wing area (gross)	845 sq. ft.
Tip area (gross)	157 sq. ft.
Area area (net of wings)	8.9 sq. ft.
Adverse area	32.95
Tip area	92.20
Wingspan length	24 ft. 2 in.
Cabin length	30 ft. 3 in.
Cabin width	3 ft. 5 in.
Anytime height	7 ft. 4 in.
Propeller ground clearance	14 in.
Wheel tire size	15.6/10 x 6
Max landing gear tread	11 ft. 9 in.
Wheel base	5 ft. 0 in.

in the center fuselage. As an example of stresses on survival and fabrication tests, the top section called "Shoulder" does have the lower edges bent upwards to act as integral struts for strength in frames. Bottom struts are not critical. Just one example.

Vertical tail supports a three-year flying two-mile and unpowered climb, rudder follows Deborah's position, with wingspan-around side centering. The tail fin is two parts, the forward portion being a flexible plate form.

Horizontal tail is a single-piece "dihedral" type with a single "tail" air flow acting as stabilizer and elevator with a full-span airfoil in its controlling movement of the control wheel. Horizontal tail also is tipped with variable balance.

Landing gear are made up of two-piece castings, with one side of the shock absorber.

Landing gear are attached except that the nose gear has a steering arm, and slightly different shock absorber design because of different shock absorbers—nose gear is the same, left and right, except for brake shock absorber position. Landing gear is stressed to take 5.1 ton speed load factor.

Peru Orders Cessna Fleet for Hinterlands

Consentment of Peru has reduced 11 Cessna to be used in a national development program of the Peruvian Andean States and the plains of the Amazon. Included in the \$100,000 order was 10 Cessnas, five of them four-cylinder and two Skylights, plus spare parts for two years of operation. The result will be delivered beginning in December.



FIELD ENGINEER

We are building advanced airborne and air transportable digital auto heading and display systems for our defense. If you understand such systems and can perform customer liaison, training, equipment maintenance, and technical consultation of the customer's site, write to Mr. Harry Lutz.

7-1 Field Development Division



LITTON SYSTEMS, INC. Data Systems Division
Georgetown, California

Here is an outstanding opportunity at

AIRLIFT CENTER U.S.A.

Located at Marietta, eight miles from Atlanta

DIVISION ENGINEER

To manage a Division composed of the Propulsion Systems Department and the Mechanical and Hydraulic Systems Department.

Requires broad experience in propulsion systems and subsystems, which include: thrust, engine mounting, exhaust systems, power plant accessories and controls, the detection and the propulsion systems, power plant fluid analysis and development systems including: propellers, power plant and fuel heating systems, power plant lubrication systems, fuel systems, oil seals.

Relevant broad experience is required in mechanical and hydraulic systems, with specific knowledge in: engine mounting, exhaust systems, power plant accessories and controls, the detection and the propulsion systems, power plant fluid analysis and development systems including: propellers, power plant and fuel heating systems, power plant lubrication systems and systems, and lubrication systems (other than power plant).

Should have a degree in Mechanical Engineering or Physics, and 15 to 20 years related experience in the field noted, at least half of which should have been in supervisory positions.

This is an exciting and challenging position in support of the latest super-sonic airplane (C-141), the Jetstar, the C-130, VTOL, and research projects.

Write in confidence to: Hugh L. Gordon, Professional Employment Manager, Lockheed-Georgia Company, Department J-175, 854 West Peachtree Street, Atlanta 3, Georgia.

An Equal Opportunity Employer

LOCKHEED-GEORGIA COMPANY

A Division of Lockheed Aircraft Corporation

Piper Seeks Lower Aircraft, Radio Costs

W. Palm Beach, Fla.—Active development program is being conducted by Piper Aircraft Corp. to add new models of single and light twin business and utility airplanes to its line in the near future, but the company has no plans to get into rotary wing, VTOL, or turbo-powered types at any time, Research and Development Vice President Howard Popert told company distributors and dealers here.

"We are restricting our R&D activities to projects which have about 90% chance of being successful," he said, "depending on our restricted and valuable time on projects that aren't almost sure things." Howard Popert stated.

Research Expansion

At the same time he noted that the company is greatly expanding its research and development activities, at both Lock Haven, Pa., and Vero Beach, Fla. A \$1,500 sq. ft. engineering building, costing approximately \$5 million and doubling former facilities at Lock Haven, has recently been completed to handle studies of future wide-engine and high-performance single-engine airplanes.

Current program indicates that the company will be introducing three new airplanes in its line over the next year and a half, all of which will be comple-

mentary to the line rather than replacement of any current types.

■ **More powerful Cessna's**, already in flight test line the new eight-cylinder four-cylinder 730-cu. in. fuel injection engine rated at 510 hp at 2,475 rpm, and 400 hp at 2,630 rpm, providing a considerable performance increase over the 180 hp and 230 hp models and giving the company a single-engine type that would be at least 20 mph faster than any comparable airplane on the market today, he said. Speed actually would be a secondary factor in the new airplane, he noted; the extra power would provide capability to carry 112 gal. of fuel, permitting very long range at economical cruise speed. The eight-cylinder 180-hp Cessna's should be able to fly 2,100 mi. or 15 hr. burning about 10 gal. and the extra power would also be useful in getting the airplane to optimum cruise altitude quickly.

■ **"Twin Cessna's"** already a probable 18 months from production, also is being tested in experimental configuration with two 160 hp. Cessna's having fuel injection systems, producing low-engine, smoothness and making the engine to be worked in area suitable for low drag. This airplane is seen by Piper as competing with Cessna's new model 330 Skycatcher product factor type.

Howard Popert also stated that the

new four-plane Cessna's "has lots of possibilities," adding that "you'll be seeing many things done with this airplane before long."

He noted that flight tests are being conducted with an Edecat winged Cessna, but that it was too early to say whether plans of this experiment and cost of certification make its installation would make it economically possible.

He stated that he didn't feel that outboard or turbojet engines would be practical for Piper's type of airplanes, but more plans to come. "If then." It would be necessary to purchase the airplane plans to take advantage of the high-thrust performance of these engines, he pointed out, and even then, outboard propeller gears would have to be cut 50-75% and specific fuel oil consumption by about one third to make these available from Piper's standpoint.

Aircraft Cost

In pointing reference to the company's new all-plastic PA-23 project (AW No. 27, p. 164), he noted that "it's not only an all-plastic airplane, but for the company and need to be constructed in such a way that the price can be made more reasonable," but also emphasized that cost of "much of the equipment is a way out of line."

"If we can get an exclusive right to a piece of equipment that is lower in price or better in some way than what the competition has, obviously, we have a sales advantage for our airplanes," the Piper executive stated. He went on to state that the company's Electronics Division at Vero Beach was established with just this principle in mind. "We have felt that the customer is not getting his money's worth in radio equipment, and that by taking a few large steps in that direction, we could save him money and help sell our airplanes as well."

Electronics Equipment

Piper Electronics started with a simplified low-frequency direction finder, selling for about \$100 installed, aimed for use in the low-cost single-engine airplanes, such as the Colt, and Cessna's. The Piper executive indicated that the company started off this program on the wing foot by providing it for use in the Cessna's line, which it now feels is too sophisticated an airplane for the simplified AutoNav unit; all the pilot wants is a basic heading device.

A more sophisticated version of this equipment, with more extensive features, will be developed to the next



LOWDER, WDSM containing a new 175 cu. ft. baggage compartment and reshaped cabin capable of fitting six persons such the 1962 Piper Astro B.

year or so, according to Howard Popert. Not equivalent to be offered is a VHF transmitter with emergency indicator, to sell for approximately \$600. When the business and market basis then is also used as a standard installation for the lower priced Piper airplanes. Shows at the meeting here, the PTE-1 incorporates a transponder power supply.

The account has a minimal weight of three watts with range range from 100 to 120 mi., transmitter has a nominal power output of two watts and incorporates 25 crystal-controlled channels.

Indications are that Piper Electronics Division technicians have in mind a broad range of future equipment. Vernon Weiss learned that, among projects under consideration is a low-cost remote radio.

New Astors

Highlight of the 1962 model presentations here was the latest version of the Piper PA-23 Astro, which has a redesigned cabin and a new, revised half-hull interior some section.

New cabin layout provides floor area of two seats, with the first two seats being individually adjustable, fore-and-aft on their floor tracks and the middle seats having three-position reclining seats.

New latest seat with maximum passenger capacity by at least one, previous models were four or five seats only.

New cabin baggage compartment in the nose provides 17.75 cu. ft. of space loading through a 50.5-in. x 39.5-in. door and the rear compartment, with a size of 20.25 cu. ft. leads through a 22.5-in. x 39.5-in. door.

New cabin layout permits conversion of the airplane, by removing all the

passenger seats, to a cargo box, capable of handling 1,120 lb. with full tanks, Piper stated.

Of considerable interest to dealer-to-dealer personnel was the fact that despite these changes, the 1962 Astro B carries the earlier price of \$12,990 for the standard equipment single airplane, not including radio. The Super Conversion version, which includes a full AC/23 communications radio set will list at \$15,990.

PRIVATE LINES

Shoppers of business and utility aircraft is right U. S. manufacturers during September totaled 443 units having a net list price totaling value of \$1,476,000, bringing the total aircraft in this category delivered to dealers and distributors in the last nine months of this year to 5,218 units valued at \$13,948,000. Piper of Vero Beach, Fla., placed the 1,058-unit, or 20 percent of its two places, "Astro" Colt as the first nine months figure.

Fleet of Gulfstream is being used by Gulf American Land Corp. to help sell business to prospective buyers at the company's Cape Coral, Fla., real estate development. The development company claims 19,000 business have been sold in the past three years with the aid of five flights each of the new jets.

Radio-equipped DC-3, equipped to suit 13 persons, has been given to the University of Illinois by its anonymous donor. Prof. Leslie A. Bova, director of the university's Institute of Aeronautics, estimated, the aircraft, including electronic equipment already installed, to be worth \$175,000. The DC-1 is the largest airplane in the university's fleet of 40 aircraft.



LOAD TRIALS on the baggage of a 1962 Piper Astro B, as performed in the static test laboratory of new Piper engineering building at Lock Haven, Pa. The facility has experimental laboratory section, electrical equipment laboratory and a flying department where flight and static tests are tested.

U.S. Business & Utility Plane Shipments			
August 1961			
Plane and Model	No. of Units	Approx. Billings	
Aero Commander 440 A, C, E, G, H, P	4	\$750,000	
Boeing 104 Super	1		
Boeing 105	1		
Boeing 106	1		
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We have changed our name to "CURTISS" DIVISION

For upwards of a quarter of a century, the Propeller Division poind the progress of thrust conversion with its piston propellers and controls. Now as the "Curtiss" Division, it will continue its tradition of quality products for defense and industry on a broader scale.

The Curtiss Division can trace its ancestry back in a Wright line to Glenn H. Curtiss, whose pioneering with aircraft and aircraft equipment led directly to the establishment of Curtiss Aeroplane and Motor Company in Buffalo, N. Y. Later in the 1930's the Propeller Department of the Company was relocated as a division of Curtiss-Wright at Caldwell, New Jersey.

Propeller design and manufacturing continue to be a substantial part of the division's activities. New, lightweight, fiber glass blades, pioneered by Curtiss-Wright, are making a scientific technological contribution to the VTOL/STOL field — and the manufacture of Electric and Turbine

propellers represents a large continuing part of the division's production.

But, as we proceed farther into the Aerospace Age, the techniques developed and perfected during 35 years of precision propeller manufacturing have been applied to mechanical control, automation, power transmission and stabilization systems for land, sea and aerospace equipment, as well as research with VTOL aircraft.

Therefore, we have changed our name to the Curtiss Division — not only to indicate that our production capabilities and engineering applications have been broadened, but to honor a great aviation pioneer, Glenn H. Curtiss.

CURTISS DIVISION
CURTISS-WRIGHT
Caldwell, New Jersey

WHO'S WHERE

(Continued from page 25)

Changes

Dr. John A. McManus, manager of corporate development, General Physics, Inc., Tuckerton, N. Y., withdrew of General Physics Corporation Corp.

Robert W. Smith, assistant manager of The Boeing Co.'s Washington, D. C., office, Wayne R. Smith, manager, NASA, and JAA Affairs for the Washington D.C. office of the Defense Electronic Products of Radio Corp. of America.

Frederick J. Harner, manager, Propeller Development Department, Radio Corp. of America.

Dr. R. E. Mills, manager, Research and Development Department, Aerospace Division, Texas Instruments Inc., Dallas, Tex., and A. Ray McGork, manager of the Division's Satellite Department.

Earle V. Gaudin, assistant manager, Aircraft Electronics Division, Radio Corp. of America.

Joseph A. Rizzo, manager of planning Electronics Division, Ford Motor Co.'s Automotive Division, Newport Beach, Calif., and Charles H. Smith, manager, Operations Staff for Electronics Division.

Dr. Peter M. Kelly, head, Instruments and Electronics Department, Aerospace Inc., Costa Mesa, Calif., a subsidiary of Douglas Aircraft Co., Inc.

Fred A. Spinks, assistant to the president, Comco Electronics Corp., Yonkers, Calif.

Norbert G. Gross, chief engineering technology, Western Electric, Menlo Park, Calif., and Robert G. Gross, chief engineering technology, Western Electric, Menlo Park, Calif.

William R. Rawlings, general manager of the newly established Mobile Radio Action Corporation, Denver (Colo.) Division of the Radio Co.

James E. Stiles, management engineering, Radio Corp. of America, Santa Ana, Calif.

Gene R. Varnes, director of research, Cedar Rapids (Iowa) Division of Collins Radio Co., according to Ralph McQuinn, now on the staff of the Defense Dept.

William F. Smith, assistant to the president of Automation, Denver, Calif., a division of North American Aviation, Inc.

Robert P. Chase, chief of flight operations, Radio Corp. of America, Yonkers, N.Y.

John W. Dwyer, general manager of Radio Corp. of America, Yonkers, N.Y.

Dr. Martin L. Dumas, manager, research and development, Western Electric Division, Radio Corp. of America, Yonkers, N.Y.

Robert L. Harner, manager, Radio Corp. of America, Yonkers, N.Y.

Frederick J. Harner, manager, Propeller Development Department, Radio Corp. of America, Yonkers, N.Y.

Charles G. Galt, general engineering manager of Electronics Div., Ford Motor Co.'s Automotive Division, Newport Beach, Calif.

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For specific details write: Mr. E. V. Newton, Personnel Office, Atomics International, 6800 Delafonte Avenue, Chino, California.

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Wasteful Procurement

The second is a misplaced premise upon the Department of Defense by the Congress in which a high percentage of competitive procurements (100% is the stated goal) is defense buying must result from a lack of permission of the public by action of the Congress. While it would appear at first glance that defense issues will be more efficiently and effectively spent if all buyers were competitive, there are four factors which make such premise most questionable:

1. Competitive bidding requires an additional budget commitment from the anticipated procurement in certain instances—a sense can derive that one only be made up by heavy economic expenditures and other expenditures.

2. Bidders frequently cannot be reasonably presented other than from the company already funded and experienced in the competitive procurement process. Competitive bidding may be more expensive.

3. Excessive competition may result in the procurement committee being so diverted from the normal cost saving that shown to the government's documents.

4. Shortened staffs expended on more additional proposals to obtain the maximum of the both engineering capability within the defense industry.

While the principle of one line ratio price system is based upon competitive bidding by means reasonably qualified, the evidence towards economic and efficient procurement in several instances is that the actual industry frequently results in 15 to 40 proposals prepared for a single contract and additional packages. The effort required to perform the study, preparation, and analysis to prepare and publish a typical proposal runs from a few thousand to several hundred thousand and in some cases a million dollars. There have been recent estimates of 30 companies vying for a request for proposal for a 170,000 development contract. Each company spent a minimum of \$15,000, thus a total of no less than \$450,000 was expended collectively for a \$250,000 purchase.

This proposal must be such, written all in general and administrative or over and repeats, which means that it is responded to such an often government release requests.

Thus DOD puts the ball of waste risk.

But even more significant is the intense doubt state of the nation's total health related engineering and scientific man power which results from excessive competitive bidding. It is well known that all companies capable that best and most experienced talent working on advanced projects and techniques in the other leading to the preparation of proposals. If a company is to survive and get at least in the all of the business it is competing for, it is forced to compete in best language in the industry. If this pattern is serious, because of excessive competition in certain branches

Admission Week welcomes the opinions of its readers on the issues raised in the regularly scheduled columns. Address letters to the Editor, Aviation Week, 330 W. 42nd St., New York 36, N. Y. For those letters under 400 words, we give a generous allocation. We will not print anonymous letters, but names of writers will be published on request.

of the defense industry that the only person available to work on the contract efforts was not the proper, less experienced engineers and scientists.

In seeking possible solutions to this situation, standard the evaluation process. The 10 proposals are usually selected to those to first firm which the final selection is made. The others are discarded to some extent as marginally acceptable and are not seriously considered further. Thus it would appear that the competition could still be restricted to the few or five bidders who present recommended or acceptable values. The problem reduced itself to how can those few best qualified bidders be selected for the competition?

There are several possibilities. Selection of qualifications and capabilities, both technical and management, by all concerned would permit the selection of the few or five best qualified. The preparation of the actual proposal and an evaluation could take more than two weeks after which the principal competitive effort can begin.

Another approach which appears to be in the process of movement is the use of the proposal effort to start the technical state of the successful bidder. The most qualified can be applied to advance the development of the best idea and approach by the successful bidder in the best interests of the government. If the government pays the normal costs of the qualified bidder in the bid to use the actual of claims in the proposal. This is precisely what is done in certain fields programs at the present time. In more complex or complex technologies, initial study programs can be awarded to the best and most qualified for the execution of the first phase of the program. The company getting back the best effort could be selected for the continuation and completion of the program. Again, because government funds are allocated by all interested participants, the best approach and techniques could be reviewed and utilized by the successful participant.

When such concepts are considered as given, arguments suggest that this process will enable the competitive between which have had much work to be more healthy. However, this procedure is more the best computer than present open bidding. An company writing to enter a sale, told how to acquire the necessary skills to maintain or improve and making a portion of its available funds. In order to provide for new men who reinforced field operations would be given an extension to substandard work as to conduct work.

These concepts are not new. They have

been used periodically by the military procurement agencies in special instances from time to time. What is suggested here is more widespread application in a broader base to eliminate much of the current waste of a previous approach known—on best scientific and engineering effort.

S. L. KATZ
Philadelphia, Pa.

Windshield Failures

As you undoubtedly know, Major Robert White's two most recent record speed flights in the X-15 have been marred by windshield failures. Inasmuch as I have received numerous inquiries about these failures, I would appreciate your printing the letter to clarify the matter.

The X-15 windshield assembly contains two completely separate panels. The outer one is a 1/4 inch thick slab of heat-treated glass which is essentially non-strengthened and serves only as a heat shield. The inner panel is a 1/8 inch laminate with a heat-treated aluminum overlayer. This inner panel covers the outer panel and also contains a transparent electrically conductive coating which acts as the windshield to prevent fogging during certain portions of the flight. In essence, the inner panel is protected from the full effects of aerodynamic heating by both the outer heat shield and a stream of nitrogen which circulates between the two panels so that the inner windshield gets no hotter than about 150°F.

Lack of the two outer failures, which the outer heat shield sustained, made the electrically heated transparent inner panel confined to function normally. It is probable that the aerodynamic heating (an excess of 1,000°F) either expanded the glass fast shield sufficiently to interfere with the mounting structure, or produced excessive thermal expansion of the mounting structure which raised the heat shield to failure. (Note that both failures occurred during or after the speed record attempt in this report in your Nov. 13 issue [p. 15], that the second failure occurred during drop from the "barrier," p. 52.)

Major White suffered considerable loss of visibility in both cases, an uncomfortable situation to be in, but he did not lose value pressure nor was he in any immediate danger himself.

Although we at Northrup supplied with the most precise windshields for the X-15, we are really amazed in my job because even with the water heat shield, research is a never ending problem will become increasingly complex as manned vehicles are being the first attempt to suffer windshield problems related to security. The X-15 is strong as long as proper which it to replace portions of heat shield light at minute intervals so that have enough can perform service missions safely and routinely.

G. L. WOOD
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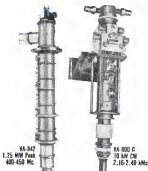


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